RI-FS FIELD SAMPLING PLAN

Falcon Refinery Superfund Site
Ingleside
San Patricio County, Texas
TXD 086 278 058

Prepared for

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ABBREVIATIONS AND ACRONYMS

API	American Petroleum Institute
AOC	Area of concern
ARAR	Applicable Or Relevant And Appropriate Requirements
ASTM	American Society for Testing and Materials
bbl	Barrels
BG	Background
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CID	Criminal Investigation Division
COPC	Chemical of Potential Concern
COPEC	Chemical or Compound or Contaminant of Potential Ecological Concern
CSM	Conceptual Site Model
DQO	Data Quality Objective
DTW	Depth to Water
EB	Equipment Blank
EPA	U.S. Environmental Protection Agency
ERA	Ecological Risk Assessment
Forms II	Field Operations Management System II Lite
FS	Feasibility Study
FSP	Field Sampling Plan
G	Grid Sample
GCC	Gulf Coast Conservation
gpm	Gallons Per Minute
GPS	Global Positioning System
HDPE	High Density Polyethylene
HHRA	Human Health Risk Assessment
HRS	Hazard Ranking System Documentation Record, Falcon Refinery
HVAC	Heating, Ventilation, and Air Conditioning
IDW	Investigation-Derived Waste
J	Judgmental Sample
MD	Matrix Duplicate
µg/L	Microgram per Liter
µg/kg	Microgram per Kilogram
mg/kg	Milligram per Kilogram
Miller	Miller Environmental
MS	Matrix spike
MSD	Matrix spike duplicate
MSSL	Medium-specific Screening Level
MW	Permanent Monitor Well
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NGVD	National Geodetic Vertical Datum
NIOSH	National Institute for Occupational Safety and Health
NORCO	National Oil Recovery Corporation
NOAEL	No Observed Adverse Effect Level
NPL	National Priorities List

OMS	Odorless Mineral Spirits
OU	Operating Unit
PCB	Polychlorinated Biphenyl
PCL	Protective Concentration Limit
PID	Photoionization Detector
Plains	Plains Marketing
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
RA	Removal Action
RAW	Removal Action Work Plan
RBSL	Risk Based Screening Level
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RPM	Remedial Project Manager
RRC	Railroad Commission of Texas
S	Soil Sample
SD	Sediment Sample
SOP	Standard Operating Procedure
STL	Severn Trent Laboratories
Superior	Superior Crude Oil Gathering
SVOC	Semi-Volatile Organic Compound
SW	Surface Water Sample
TACB	Texas Air Control Board
TB	Trip Blank
TCEQ	Texas Commission on Environmental Quality
TCLP	Toxicity Characteristic Leaching Procedure
TNRCC	Texas Natural Resources Conservation Commission
TPH	Total Petroleum Hydrocarbons
TRV	Toxicity Reference Value
TW	Temporary Monitor Well
UCL	Upper Confidence Level
USCS	Unified Soil Classification System
VOC	Volatile Organic Compound
VSP	Visual Sample Plan
WBZ	Water Bearing Zone

1.0 INTRODUCTION

The following Field Sampling Plan (FSP), prepared by Kleinfelder, on behalf of National Oil Recovery Corporation (NORCO), defines the sampling and data gathering methods that will be used to define the nature and extent of contamination and human and ecological risk for the former Falcon Refinery located near Ingleside, Texas (Figure 1). Specifically, the plan will include sampling objectives, sample locations and frequency, sampling equipment and procedures and sample handling and analysis. All work will be performed in compliance with the U.S. Environmental Protection Agency's (EPA) guidance document titled, "Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA".

Field sampling activities related to the disposal of on-site hazardous materials (referred to as the Removal Action (RA)) at the former Falcon Refinery site in San Patricio County, Texas will be performed in accordance with the approved FSP.

The Quality Assurance Project Plan (QAPP) is a companion document to this document and provides information concerning the rationale for the sampling strategy, laboratory procedures and the Quality Assurance/Quality Control (QA/QC) procedures that will be employed in this FSP.

References that are listed in this FSP refer to the same references identified in the Falcon Refinery "Hazard Ranking System Documentation Record" (HRS) (TNRCC, February 2002). All references and project related documents may be viewed at the local repository located at:

Ingleside Public Library
2775 Waco Street
PO Drawer 400
Ingleside, Texas 78361

1.1 Phase I Investigation

Described in this section is the Phase I assessment plan for this FSP. Details of the methodologies used to perform the activities are described on the Standard Operating Procedures (SOP) in Appendix A.

Since little information exists on the distribution of chemical risk drivers at the Site, the sampling strategy will be carried out in at least two phases. Some prior knowledge of chemical distributions is required before performing statistical calculations to be used in the determination of the minimum number of samples required to meet the objectives of the Remedial Investigation and Feasibility Study for the Site.

For Phase I, the number of soil, sediment, groundwater, and surface water judgmental or random-grid sampling locations was initially determined by the Site Team and is not based on the distribution of the risk drivers, if any, for the Site. Ideally, Phase I will determine the distribution of the risk drivers for the Site.

When the data from Phase I are obtained and analyzed the standard deviation, alpha and beta error rates, width of the gray region, and a threshold value (screening value) will then be used in Phase II as input into Visual Sample Plan software algorithms to statistically determine the minimum number of samples required to meet the Data Quality Objectives for the Site. Another scoping meeting will be held to evaluate the data gathered during Phase I and to determine the actions required for Phase II.

For human health and ecological risk assessment screening purposes, any chemicals detected at the Site above their respective screening levels will be carried forward in the risk assessments required by the National Contingency Plan (NCP), taking into account synergistic effects. For ecological risk assessment screening purposes, bioaccumulative chemicals may need to be carried forward in the risk assessment if found below their respective screening levels.

For both the human health and ecological risk assessments, the maximum detected concentrations will be used for risk screening purposes. The statistically derived 95 percent upper confidence limit (UCL) of the arithmetic mean (if the sample size is adequate) or maximum concentration (if the sample size is inadequate), whichever is appropriate for a given medium, will be calculated for use as the concentration term in the risk assessment equations following the risk screening process. The statistical methods described in the EPA's guidance documents for calculating UCLs are based on the assumption of random sampling.

1.1.1 On-Site Investigation

NORCO acknowledges that the EPA uses the term "Site", which is not defined in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), in referring to a "release" or "facility" on the National Priorities List (NPL). However, for this FSP the term Site (upper case S) or on-site will be used to describe property owned by NORCO including the North Site, South Site and the Barge Dock Facility. When referring to the overall area the term site with a lower case "s" or off-site will be used.

The following on-site sampling activities will be performed:

- Collect judgmental surface and subsurface soil samples at former operating units (OU) at the north and south Sites using a Geoprobe ® or hand sampling device.
- Collect random start grid composite surface and subsurface soil samples from areas of the Site that are not associated with former OUs using a Geoprobe ®.
- Install and sample temporary monitor wells using a Geoprobe ® at locations with the highest probability of groundwater impacts. The temporary monitor wells will be abandoned prior to demobilization from the Site.

1.1.2 Off-Site Investigation

The following off-site sampling activities will be performed:

- Collect judgmental sediment, surface and subsurface soil samples at background locations in areas located outside the area of probable impact from the Site, in similar settings to those being evaluated;
- Collect judgmental surface and subsurface soil at residential locations adjacent to the Site;
- Collect random start grid sediment samples in the wetlands;
- Collect judgmental sediment and surface/subsurface soil samples along the active and inactive pipelines that lead to the current and former barge dock facilities; and
- Sample surface water in the wetlands and bay adjacent to the Site.

1.2 Phase II Investigation

After the completion of Phase I a scoping meeting will be held to evaluate the data gathered during Phase I and to determine the actions required for Phase II. Activities performed in addition to Phase I activities will be documented as addenda to the current QAPP and FSP. Phase II investigation activities may include:

1.2.1 On-Site Investigation

- Additional surface and subsurface soil sampling;
- Installation of permanent monitor wells;
- Additional groundwater sampling; and
- Characterization of aquifer properties.

1.2.2 Off-Site Investigation

- Additional sediment sampling in the wetlands and bay;
- Biota sampling;
- Additional surface water sampling;
- Additional surface and subsurface soil sampling; and
- Installation of off-site monitor wells and groundwater sampling.

1.3 Sampling Objectives and Design

This FSP is based on site-specific data quality objectives (DQOs) developed from the comprehensive conceptual site model (CSM) and based on EPA and TCEQ guidance documents. EPA's DQO process is an important tool for defining the type, quality, and quantity of data needed to make defensible decisions.

The DQO approach is a seven-step, iterative process for preparing plans for environmental data collection activities. The DQO approach uses a systematic process for defining the criteria of a data collection design, which includes: when, where, and how to collect samples or measurements; a determination of tolerable decision error rates; and the number of samples or measurements that should be collected. Section A7 of the Falcon Refinery QAPP presents the DQOs developed for the Falcon Refinery Remedial Investigation (RI).

This FSP presents the sampling design and scientific methods that will be applied to achieve the DQOs defined in the QAPP. It also establishes the methods and procedures that will be used to collect, handle, and manage the data. Kleinfelder will document any changes to the FSP in a memorandum to the EPA Remedial Project Manager (RPM). This FSP includes the following sections and appendices related to activities planned for Phase I of the RI:

- Conceptual Site Model (Section 2.0)
- Sampling Objectives (Section 3.0)
- Field Investigation (Section 4.0)
- Sample Designations (Section 5.0)
- Sampling Equipment and Procedures (Section 6.0)
- Sample Handling and Analysis (Section 7.0)
- Schedule (Section 8.0)

This FSP also includes the following appendices:

- Standard Operating Procedures (Appendix A)
- Example Field Data Sheets (Appendix B)
- North Site Release Report (Appendix C)
- Plains Marketing Boring Logs (Appendix D)
- Comparison of Quantitation Limits to Ecological Screening Standards (Appendix E)
- Comparison of Quantitation Limits to EPA Region 6 MSSLs and TCEQ Tier 1 Protective Concentration Limits (PCLs) (Appendix F)

2.0 CONCEPTUAL SITE MODEL

The purpose of the CSM is to identify pathways for contaminant transport and impacted media and receptors. In preparing the CSM, data gaps were identified based on the data needs for defining nature and extent of contamination, conducting the Ecological Risk Assessment (ERA) and Human Health Risk Assessment (HHRA) and evaluating presumptive remedies for the site, if needed. Site-specific DQOs were developed based on the CSM and were subsequently used to develop the QAPP and this FSP for the site.

2.1 Physical Profile

The Falcon Refinery Site consists of a refinery that operated intermittently and is currently inactive. When in operation, the refinery had a capacity of 40,000 barrels per day and the primary products consisted of naphtha, jet fuel, kerosene, diesel, and fuel oil.

The Site occupies approximately 104 acres in San Patricio County, Texas, and is located 1.7 miles southeast of State Highway 361 on FM 2725 at the north and south corners of FM 2725 and Bishop Road (Figure 2, Site Map)**.** Other portions of the site include piping leading from the Site (North and South) to dock facilities at Redfish Bay, where crude oil and hydrocarbons were historically and are currently transferred between barges and storage tanks, and any other area where contamination attributed to the site has come to be located.

The Site is divided into the North Site, South Site and current barge dock facility. There are pipelines that connect the North and South Sites with the current and former barge dock facilities.

2.1.1 North Site

When operational, the storage and truck rack property (North Site) had nine above ground storage tanks, that ranged in capacity from 1,000 barrels (Tank 3) to 20,000 barrels (Tanks 8 and 9), three truck loading racks, associated piping and a transfer pump (Figure 3).

At the time of the submission of this FSP only Tank 2 and Tank 7 from the North Site remain intact. Three small tanks (<1,000 barrels) have been placed at the North Site near the former truck racks, since the facility was operational. The tanks and the contents of the nearly empty tanks are the responsibility of a contractor that worked at the facility. NORCO is in the process of having the tanks properly removed. Tanks 2 and 7 are approximately 10% full. Disposal of the contents of the tanks have occurred under the Removal Action Work Plan (RAW).

The North Site is bordered by Plains Marketing to the north, northeast and northwest, FM 2725 to the southeast and Bishop Road to the southwest. Across Bishop Road are residences and across FM 2725 are several commercial properties.

2.1.2 South Site

The South Site includes the main operation portion of the refinery (Figure 4) and included the control room, heaters, crude towers, coalesers, boilers, fire water tank, exchangers, cooling towers, desalters, exchangers, compressors, a lab, above ground tanks 10 through 31, tanks N1 and N2, an American Petroleum Institute (API) separator, clarifier and an aeration pond.

At the time of this submission, tanks 28, 29 and 31 have been removed and the control room and laboratory have been decommissioned.

The South Site is bordered by Bishop Road to the northeast, FM 2725 to the northwest, wetlands to the east and south and County Road CR-152 to the southwest. Across Bishop Road and FM 2725 there are residences.

At the time of this submission the South Site is being used by Superior Crude Gathering Inc. (Superior) to store and transport crude oil.

2.1.3 Current Barge Dock Facility

The current barge dock facility is located on Redfish Bay (Figure 5) and was previously used to load and unload crude oil and refined hydrocarbons via pipelines that connect the dock facility to the North and South Sites. The fenced dock facility contains a dock and several small structures to load and unload crude oil.

Currently only crude oil is transferred at the Site.

2.2 Facility Profile

When operational the refinery produced light naphtha, heavy naphtha, kerosene and diesel. Operational equipment at the Site includes a cooling tower, crude exchanger, steam generator, vacuum cooler, blending equipment, heat exchangers, charge pumps, residue pumps, slop pumps, condensate pumps, water circulating pumps, sulfuric acid injection pumps, cooling water pumps, a vacuum column, condensate separator, flame arrestor, chlorinator, steam exhaust, chemical feed system and a Heating, Ventilation, and Air Conditioning (HVAC) pressurizing system. Storage consisted predominantly of Tanks 10 through 31, which ranged in size from 5,000 barrels (Tanks 17-24) to 200,000 barrels (Tank 30). Two additional tanks N1 and N2, were also used to store product, including CERCLA hazardous substances and there is a large fire water tank near the main entrance to the facility.

Storm water and process water were sent to storage tanks that had API separators that removed any residual oil and sent the oil to a slop tank. The water was treated by a dissolved air flotation chamber and then flowed into the aeration pond. Sludge was then removed in the clarifier and it is believed that any effluent from the refinery’s wastewater treatment system may have been historically discharged directly into the unpermitted wetland area immediately adjacent to the

Site since the discharge pipeline may have never been constructed to the outfall discharge point. During operation the refinery processed material that consisted of not only crude oil but also contained hazardous substances, as defined by 40 CFR Part 261.32. In a Notification of Hazardous Waste Activity, signed on October 20, 1980 by Mr. Eugene W. Hodge, Vice President of UNI Refining, Inc, four hazardous wastes from specific sources were listed: K048 (dissolved air flotation float), K049 (slop oil emulsion solids), K050 (heat exchanger bundle cleaning sludge), and K051 (API separator sludge). Of these sources, the listed hazardous waste K051 was documented in an inspection report to have been deposited inside the walls of a tank berm. Other hazardous substances at the site included: vinyl acetate detected inside tanks during a EPA Criminal Investigation Division (CID) criminal investigation and a TNRCC Region 14 sampling event, chromium detected in deposited cooling tower sludges and untreated wastewater releases inside tank berms.

On March 12, 1986, an inspection conducted by the Texas Water Commission revealed that the Falcon Refinery had disposed of cooling tower sludges on-site. These sludges were sampled and the laboratory reported a total Chromium of 8020 milligrams per kilogram (mg/kg) and an EP Tox Chromium of 46 micrograms per kilogram (ug/kg). The inspector noted that, during December 1985, the Falcon Refinery made a 100,000-barrel run of slop oil, which generated a substantial amount of very odorous wastewater. The refinery's wastewater treatment system was inoperable during this run. The refinery placed untreated wastewater in tankage and then, ultimately, discharged the untreated wastewater into sandy, unlined containment structures (fire walls). According to a 1986 inspection report, the untreated wastewater was discharged into the bermed areas around tanks 10, 11, 26, and 27. A sludge, which had been dumped inside the fire walls of tank 13, was observed and sampled during the inspection of July 1986, by TNRCC Region 14 staff. Constituents found in the sample included naphthalene, 2,4-dimethylphenol, acenaphthene, fluorene, phenanthrene, fluoranthene, pyrene, and chrysene.

On January 13, 1987, the Texas Air Control Board (TACB) took a sample from a wastewater storage tank at Falcon Refining. Records indicate that the refinery received 104,000 barrels (bbl) of material from Tenneco in January 1986. A substantial amount of this waste remained in the pipelines and tanks. TACB officials noted that noxious odor complaints from surrounding residents began when the refinery started processing this material. TACB concluded that the Tenneco material was not virgin petroleum, but a mixture of organic solvents and, probably, waste. TACB analytical results from a sample of material taken from a tank on January 13, 1987, support the conclusion that this material contained constituents not normally occurring in crude oil. Butanol, cyclohexanediol, 1 phenylethanol, N,N-diphenylamine, and xylene were detected in the sample of wastewater from the refinery.

An Inspection by the TACB on April 10, 1987, revealed a black, liquid substance beneath a pipeline rack on the north side of the refinery from a leak in the third pipeline (10-inch diameter) from Bishop Road. The black, liquid appeared to be either a solvent with hydrocarbon/carbon or a crude oil with solvents intermixed. The pipeline connects the tank farm in the refinery to a run-of-pipe from the docks, which were used to transfer material into and out of the Falcon Refinery tank farm. The final spill covered an area approximately 30 feet by 60 feet. Investigations on

April 20 and 21, 1987, did not indicate any apparent effort to remove the spilled material, which was creating an odor problem. ARM Refining, located on the west side of FM 2725 and on the north side of Bishop Road, covered the spill on April 22, 1987.

On November 15, 1995, a spill was reported south-southeast of FM 2725 on Bishop Road, in the wetlands adjacent to the Brown & Root Facility. The spill occurred during a hydrostatic test of a pipeline prior to bringing the line back into service. The underground pipeline runs from the dock facility to the main facility. Approximately less than eight barrels of "crude oil" were spilled. According to Mr. Bernie Eickel of the Railroad Commission of Texas (RRC), the sample analyses on February 7, 1996, indicated the presence of substances other than crude oil. Two contaminated soil piles and two roll-off containers containing regulated waste associated with the spill resulted from the waste removal activity. Analyses of the February 7, 1996, samples (collected from one roll-off and liquid material leaking from the roll-off) indicated constituents not normally found in crude oil and elevated levels of the following constituents: tetrachloroethene, 2-methylnapthalene, phenanthrene, toluene, and total xylenes.

On February 16 and 19, 1996, an inspection was conducted by the TNRCC Region 14 staff at the NORCO facility in response to an alleged crude oil pipeline spill from the facility on November 15, 1995. Analysis of the spilled residuals revealed constituents not naturally occurring in crude oil. Mercury, lead, 1,2, dichloroethane, benzene, ethyl benzene, styrene, toluene, total xylenes, chrysene, m-creosol, o-creosol, p-creosol, fluorene, methyl isobutyl ketone, 2-methylnaphthalene, naphthalene, phenanthrene, pyrene, methyl t-butyl ether, total organic halogens, and vinyl acetate were detected in the samples collected. Vinyl acetate was detected in tanks N1 and N2. Vinyl acetate is not an ingredient in crude oil nor does it substitute for other products, as it has no solvent properties, thus exempting the chemical from the petroleum exclusion.

On April 4, 1996, Jones & Neuse conducted grid sampling at the spill site. The samples were analyzed for benzene, toluene, ethyl benzene, and xylene (BTEX) and total petroleum hydrocarbons (TPH). No BTEX content was detected in the soil samples taken, but TPH levels were detected ranging from 67 to 1930 mg/kg.

The EPA CID of the Houston Area Office conducted a criminal investigation from January 1996, until August 2000, on the activities at Gulf Conservation Corporation (GCC), a facility located north of the dock facility and at the NORCO facility, which was being operated by MJP Resources, Inc. Specifically the investigation concerned a vinyl acetate slop stream delivered to GCC. According to Mr. Ronald Cady, Louisiana Department of Environmental Quality Regional Hazardous Waste Coordinator, and Mr. Brian Lynch, CID, this stream consisted of odorless mineral spirits (OMS) that were used as a carrier for the reactant in the production of polyethylene at Westlake Polymers in Sulphur, Louisiana. In this process, the mineral spirits are recycled until they become too contaminated to use and would be classed as a spent solvent. Westlake Polymers segregates the two streams and labels them V-240 (OMS) and V-242 (OMS with VA). In the past, they had been classifying the mineral spirits as a co-product. The vinyl acetate is not an excluded substance under the petroleum exclusion.

Samples were collected by the CID in February 1996 from two tanks (N1 and N2), also referred to as Tanks 32 and 33 in the main processing area of the NORCO facility. The liquid samples collected revealed high concentrations of vinyl acetate in these two tanks; 1,360,000 micrograms per liter (ug/L) and 36,600,000 ug/L.

It should be noted that NORCO did not own, operate or have any relationship with GCC at any time. Trucks delivered the liquid described in the previous paragraph from GCC to the Falcon Refinery pursuant to permission given by the MJP Resources, Inc. President, a previous lessee of the Falcon Refinery.

On January 4, 2000, TNRCC Region 14 inspectors completed a compliance inspection pertaining to the air quality requirements for permitted tanks. These tanks are located on the northwest quadrant of the FM 2725 and Bishop Road and are authorized in three active TNRCC air permits. The naphtha stabilizer unit, located in the main processing area in the southeast quadrant of FM 2725 and Bishop Road, was observed to be leaking from a valve between the sight glass and the tank. This valve was approximately 20 feet high and the wind was blowing a shower of leaking fluid on to an area of soil and vegetation surrounding the tank. Two 8-ounce jars of sample were collected of the liquid as it leaked from the valve. Based upon the flow rate of the leak observed on January 7, 2000, and the Site inspections conducted on January 4, 6, 7, 10, and 11, 2000, it was determined by the TNRCC Region Office that a total volume of at least 220 gallons of material had leaked from the tank.

Groundwater at the NORCO facility has been contaminated as a result of the release, per the March 7, 2000 report. Laboratory analyses received by the TNRCC Region 14 Office on February 25, 2000 revealed the following constituents; 1,2 dichloroethane, 4-methyl-2-pentanone (Ref. 38, p. 180), benzene, ethyl benzene, m,p,oxylenes, styrene, and toluene (Ref. 38, pp. 44-50). The analyses also revealed that the fluid sample exceeded the maximum concentration of benzene for toxicity characteristic using the toxicity characteristic leaching procedure (TCLP).

The hazardous substances identified on-site included such chemicals as nitric acid, acetic acid, cupric chloride, potassium chromate, silver nitrate and potassium hydroxide. Additionally, the EPA believes that hazardous wastes and residues identified by the Resource Conservation and Recovery Act (RCRA) waste numbers D002, K049 and K051 are also present. All of the hazardous wastes and substances are “hazardous substances” as defined by Section 101(14) of CERCLA, 42 U.S.C. § 9601(14), and CFR § 302.4.

On April 4, 2002, there was a spill of approximately 20 gallons of crude oil on property owned by Offshore Specialty Fabricators (Reference C on the CD provided by the EPA describing spills). The spill was in the wetlands north of Sunray Road. On July 29, 2002 the Texas Natural Resources Conservation Commission (now the Texas Commission on Environmental Quality) issued a letter to Mr. Dickey Henderson (Offshore Specialty Fabricators, Inc.), which indicated that the apparent cause of the release is a series of abandoned pipelines on Offshore Specialty’s property. A RRC report dated April 4, 2002, states that employees dug a hole approximately twelve (12) feet deep and found no clean sand. Samples of the liquids present at the spill site, taken by the RRC on April 15, 2002, were analyzed and revealed the presence of vinyl acetate. A RRC report dated April 16, 2002, states that additional seepage was found from suspected unknown pipelines approximately 10 feet from the water of the salt marsh on the north end of Sunray Road. According to the RRC report, the lines were suspected to be UNI (a previous owner of the Falcon Refinery) lines.

On September 20, 2002, after a heavy rain, Tank 7 from the North Site overflowed and between 500 gallons and 500 barrels of crude oil (the document record includes both amounts) was estimated to have been spilled. The crude oil filled the bermed area around the tank and spread to the east toward Hwy 2725. The spilled material migrated across Hwy 2725 and eventually flowed within the drainage ditch toward Bishop Road and then followed the drain ditch east along Bishop Road. Some of the crude oil and water that traveled along the drainage ditch was deposited on Thayer Road and a residence. Much of the impacted area has since been paved.

NORCO hired Miller Environmental (Miller) to respond to the release and Miller used vacuum trucks and absorbent pads to remove as much of the spilled material as possible. After the free liquid was removed, Miller excavated the impacted soil, sampled the area and replaced the soil. Sampling of the soil met the Texas Commission on Environmental Quality (TCEQ) closure requirements. Reports describing the release are included in Appendix C. During 2004, after heavy rain, a sheen was noted in the drainage ditch across Bishop Road from the North Site.

Heavy rain also caused Tanks 26 and 27 at the refinery to overflow, spilling oily waste onto the ground. Since that time NORCO has been removing the contents of the tanks and they are both approximately 20% full at the time of the submission of this work plan and there is no chance that the tanks will overflow.

2.3 Areas of Concern

Seven areas of concern (AOC) have been identified as potential areas with contamination. Three AOCs are identified on-site and four are off-site. AOCs are summarized in Table 1 and shown on Figure 6**.** Each AOC is discussed in the following sections.

For the purposes of this investigation, soil sample intervals will be divided into surface and subsurface soil. Surface soil will be defined as soil that exists at a depth of 0.0 to 0.5 feet below ground surface (bgs) and subsurface will include all depths below surface soil.

2.3.1 AOC-1 Former Operational Units (OU)

Included in AOC-1 are the entire North Site, former operational unit (OU) areas of the South Site a drum disposal area and an area where metal waste was discarded (Figure 7). Described in Section 2.2 of this FSP are several releases that occurred in this AOC. In addition to the historical record of releases, there are several locations within AOC-1 where grossly stained soil is evident. Grossly stained soil is being addressed in the Removal Action Work Plan (RAW) for the site.

As noted in the QAPP, to properly address AOC-1 judgmental sampling was selected by the project team during a scoping meeting held on April 13, 2006.

When operational the refinery produced light naphtha, heavy naphtha, kerosene and diesel, however there are documented instances of waste being stored and released from the Site. Preliminary contaminants of potential concern (COPCs) to be screened at this AOC include metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs) and pesticides/herbicides.

Potentially affected media include soil and groundwater.

2.3.2 AOC-2 On-Site Non Operational Areas

Included in AOC-2 are areas of the refinery that have not been used for operations or storage and have no record of releases (Figure 8). Encompassing approximately 25 acres the AOC is located between operating portions of the refinery and FM 2725 to the west and southwest and CR-152 to the south and southwest.

Although no contamination is anticipated in this area the COPCs to be screened at this AOC include metals, VOCs and SVOCs.

Potentially affected media include soil and groundwater.

2.3.3 AOC-3 Wetlands

Included in AOC-3 are 1) the wetlands immediately adjacent to the Site that are bordered by Bay Avenue, Bishop Road and a dam on the upstream side, 2) the wetlands located between Bishop Road, Sunray Road, Bay Avenue and residences along Thayer Avenue and 3) the wetlands between Sunray Road, residences along FM 2725, Gulf Marine Fabricators, Offshore Specialty Fabricators and the outlet of the wetlands into Redfish Bay (Figure 9).

There is one active and several abandoned pipelines that lead from the refinery to the current and former barge dock facilities. During June 2006 the abandoned pipelines were cut, the contents of the pipelines were removed and plates were welded on the pipelines. These activities were performed under the RAW.

Assessment activities in the wetlands will evaluate releases from the refinery, including the unpermitted wastewater effluent discharge into the wetlands, releases into the wetlands from two known pipeline releases, and the possible releases from the pipelines leading from the refinery to the current and former barge dock facilities.

There have been documented spills into the wetlands of hydrocarbons, waste and volatile organics. As a result the COPCs to be screened at this AOC will include metals, VOCs, SVOCs, PCBs, herbicides and pesticides.

Potentially affected media include sediment, soil, surface water and groundwater.

2.3.4 AOC-4 Current Barge Docking Facility

Included in AOC-4 is the current barge docking facility, which is approximately 0.5 acres and is located on Redfish Bay (Figure 10). The fenced facility, which is connected to the refinery by pipelines, is used to load and unload barges. At the time of this report only crude oil passed through the docking facility. Historically however, refined products were also loaded and unloaded.

There have been no reported releases nor is there evidence of spills associated with this AOC. Therefore the COPCs to be screened at this AOC will be limited to metals, VOCs and SVOCs.

Potentially affected media include soil and groundwater.

2.3.5 AOC-5 Redfish Bay

Included in this AOC are the sediments and surface water adjacent to the current and former barge dock facility (Figure 11). The COPCs to be screened at this AOC will include metals, VOCs and SVOCs.

Potentially affected media include sediment and surface water.

2.3.6 AOC-6 Thayer Road

Included in this AOC is the neighborhood along Thayer Road, which is across Bishop Road from the refinery (Figure 12).

The COPCs to be screened at this AOC include metals, VOCs and SVOCs.

Potentially affected media include soil and groundwater.

2.3.7 AOC-7 Bishop Road

Included in this AOC is the neighborhood along Bishop Road, which is across Bishop Road from the North Site (Figure 13).

The COPCs to be screened at this AOC include metals, VOCs and SVOCs.

Potentially affected media include soil and groundwater.

2.3.8 AOC Summary

In summary, surface and subsurface soil, groundwater, surface water and sediment have potentially been contaminated as a result of leaks and spills of fuels and/or chemicals used during refining, transportation and storing, as well as overflow, storm water run-off, and direct application of potentially contaminated media may have acted as release mechanisms for contaminants on Site. Infiltration and leaching of contaminants may have also contributed to the movement of contaminants vertically. Groundwater beneath the site may have been impacted through infiltration of contaminants or by contaminants leaching from the soil. Potential off-site contamination of soil may be the result of releases from the Site, the dispersion of airborne particles containing metals, releases from pipelines or storm water runoff directly from the Site.

2.4 Land Use

Land use at the site has historically been commercial/industrial in nature; however, there are residential areas immediately adjacent to the Site. NORCO will deed record the Site for commercial/industrial use only. Therefore, action levels for sampling will be primarily based on preliminary remediation goals calculated from human health risk assessment guidance for commercial/industrial application at the Site and residential scenarios off-site.

Initially, commercial/industrial and residential EPA Region 6 human health medium-specific screening levels (MSSL) (EPA 2007) and TCEQ Tier 1 PCL screening levels for residential land use will be used as screening levels for affected media.

2.5 Release Profile

Figure 14 presents the CSM human health and ecological exposure pathway analysis in a flowchart, and Figures 15a and 15b are schematic representations of the human health and ecological exposure pathways, respectively, for the site. Release scenarios to be addressed include releases to on-site and off-site soil, groundwater, surface water, sediment, and air. Each of these scenarios is described in the following subsections.

2.5.1 Releases to Soil

The most likely causes of releases to soil are leaks or spills associated with the tanks, pipelines, drum storage and the placement of "spent" materials on the ground. Site activities may have resulted in contamination from hydrocarbons, other organic solutions, and possibly caustic solutions. Metals may have been released to soil as a result of leaching of materials that had been placed on the ground.

Storm water runoff during storm events may have spread contamination both on Site and to off-site areas.

2.5.2 Releases to Groundwater

The depth to groundwater beneath the Site has been estimated at 3 to 8 feet bgs. No permanent groundwater monitor wells have been installed at the Site, however monitor wells at the adjacent Plains Marketing (Plains) site encountered groundwater in that range. Provided in Appendix D are boring logs from Plains.

In addition to the presence of hydrocarbons noted near the above ground tanks at the Site, other potential sources of groundwater contamination include on-site and off-site pipelines, above ground storage tanks, former drum storage areas, oil pits, and metal refuse areas.

Releases to groundwater may have also occurred as a result of storm water runoff during storm events that may have spread contamination both across the Site and to off-site areas.

The receptors potentially exposed to shallow groundwater are described in Section 2.6, consistent with the CSM (Figure 14).

2.5.3 Releases to Sediment and Surface Water

Releases to surface water and sediments may have occurred as a result of runoff from contaminated surface soils, overflow from tanks, direct discharge from the unpermitted wastewater treatment system, or spills directly into the wetlands from pipelines. Releases could also occur where impacted ground water interfaces with these media. Due to the low-lying nature of the site, significant surficial runoff is expected during periods of heavy rain.

2.6 Receptor Profile

Historical site documents and analytical data indicate that metals, VOCs and SVOCs are the preliminary COPCs for this site. Limited sampling for PCBs and pesticides/herbicides will be performed in AOC-1, AOC-3 (in the wetland area located immediately southeast of the refinery and bounded by Bishop Road and Bay Avenue), AOC-4, AOC-6, and AOC-7.

Based on the AOCs identified in Section 2.3 and the media releases described in Section 2.5, current and future exposure pathways were discussed at scoping meetings and included in the CSM. Below are descriptions of the complete and incomplete exposure pathways and the receptors involved for each.

The CSM is a dynamic planning tool for the remedial investigation/feasibility study (RI/FS), by design. Suspected areas of concern are being investigated in Phase I of the RI/FS field effort; some AOCs or some potentially affected media may not be contaminated. Potential secondary and tertiary sources as shown in Figure 14 have not been fully characterized as actual sources of contamination. This RI will further define secondary sources. On-site and off-site soil, drainage, storm water, and groundwater are potential secondary sources of contamination, and are included in the CSM and the discussion of potentially complete pathways.

2.6.1 Human Exposure Pathways and Receptors

Described in this section is the rationale for evaluating certain media and their relation to the CSM (Figure 14). This analysis will be updated in the HHRA, if necessary, to reflect new information regarding complete exposures as revealed by the Phase I RI/FS field effort.

2.6.1.1 Soil-Related Human Exposure Pathways

The potentially complete soil contaminant exposure pathways being considered at this time for humans include:

- Incidental ingestion of contaminated soil in on-site and off-site areas, taking possible future use scenarios into consideration;
- Dermal contact with soil; and
- Inhalation of newly re-suspended airborne soil particles in either on-site or off-site areas.

Based on the Phase I data, these potentially complete soil-based pathways (marked with a filled in circle in the CSM, Figure 14) will be evaluated for the receptors shown in Figure 14. This includes a current/future on-site worker, an on-site trespasser who wanders off-site, and an off-site resident family (child and adult).

Gardens will be assumed to exist in the residential areas of the Site and will be considered in the Conceptual Site Model, along with the possibility that children play in the yard and could be exposed to contaminated soils.

Potentially complete pathways that are reserved for potential Phase II evaluation include the site-specific contribution of contaminated off-site indoor dust in AOCs 6 and 7. Until the area where outdoor soil impacts are confirmed (based on the Phase I off-site residential sampling, comparison to site-specific background, and conclusion of attribution), dust sampling is reserved for Phase II, if needed, to minimize disturbance of off-site residents.

2.6.1.2 Groundwater-Related Human Exposure Pathways

Groundwater has been included as a secondary source of contamination, assuming releases from Site processes have migrated via infiltration and leaching to subsurface soils and finally, the shallow aquifer.

No off-site groundwater impacts are suspected, and thus groundwater exposures to current/future off-site residents are incomplete. If the Phase I on-site groundwater sampling does not identify the extent of contamination horizontally as contained on-site, potential future Phase II sampling of groundwater off-site may be considered, and the CSM would be revised as necessary.

2.6.1.3 Surface Water-Related and Sediment-Related Human Exposure Pathways

The wetlands adjacent to the Site are used by duck hunters, as evidenced by the presence of duck blinds and decoys. The wetlands drain into Redfish Bay, which is used for swimming and other recreational pursuits. Where appropriate, our estimates of dermal and incidental ingestion exposures via surface waters and sediments for recreational use scenarios will rely upon the default values and assumptions described in Section 5 of the relevant TCEQ guidance document (TCEQ 2002).

2.6.1.4 Air Deposition-Related Exposure Pathways

Because actual process emissions are historic, the complete inhalation pathways for the site all now relate to secondary releases from soil. Thus, exposures resulting from inhalation of particulates will be assessed for all human receptors exposed to soil. As noted in Section 2.6.1.2, at this time no VOC plume is suspected to impact overlying soils or future indoor air on-site, and therefore, these groundwater-to-air inhalation pathways are considered incomplete. If the Phase I RI/FS field effort identifies previously unknown contamination that changes these or other media-based assumptions, the CSM will be updated (in the HHRA) to reflect these findings so that no complete exposure pathway is left un-assessed.

2.6.2 Ecological Exposure Pathways and Receptors

Described in this section are the rationale for evaluating certain media and their relation to the CSM. This discussion will be updated in the ERA (if necessary) to reflect new information regarding complete exposures, based on the Phase I RI/FS field effort.

The RI will indicate which ecological receptors are at risk of exposure via which media. Within the framework of the CSM, the current ecological receptors at potential risk are primarily off-site terrestrial and aquatic wildlife.

Because the coastal wetland complex that occupies the site directly contributes to the nearby Redfish Bay, a list of potential special-status species receptors has been identified. In the Redfish Bay environment, the known threatened and endangered species include: Federal and State listed endangered species, Brown Pelican (*Pelecanus occidentalis*); State listed threatened species, Reddish Egret (*Egretta rufescens*); Federal listed endangered species, Kemp's Ridley Sea Turtle (*Lepidochelys kempii*); and Federal listed threatened species, Green Sea Turtle (*Chelonia mydas*).

A Kleinfelder biologist conducted a preliminary two-day project site survey on May 31st and June 1st of 2006 to determine the presence of special-status plants and animals and their associated habitats. Based upon this two-day survey, the presence of potentially suitable habitat exists both on and off-site for the following special-status species: White-faced Ibis (*Plegadis chihi*), Opossum Pipefish (*Microphis brachyurus*), and the West Indian Manatee (*Trichechus* *manatus*) within the Redfish Bay system.

Although potentially suitable habitat for these special-status species occurs on and adjacent to the project site, it does not guarantee the presence of or optimum use by special-status species. Additional species-specific focused surveys will be needed to ascertain this data.

Both federally-listed and state-listed species shall be addressed in the ERA. In order to eliminate a threatened/endangered species as being potentially present, an ERA will provide supporting documentation from a wildlife management agency to confirm the absence of the protected species on the affected property. If this is not possible due to the time constraints associated with the project, a discussion will be provided for the lack of suitable habitat by comparing the available habitat with the habitat needs of threatened/endangered species that could possibly occur in the county. It will not be enough to simply assume that no protected species are known to occur at the Site.

If the presence or absence of a protected species cannot be determined, then the species will be considered as being present and potentially impacted. For species known to use the area or suspected to use the area due to habitat suitability, the ERA must then demonstrate through exposure or action level determination that the species will either not be impacted, or that protective clean up levels will be developed. These demonstrations are usually accomplished by calculating the exposure and evaluating the risk to a receptor that is a surrogate (a receptor from the same feeding guild) for the protected species. In this case, the ERA should also explain why the particular receptor chosen is a suitable surrogate for the sensitive species. Finally, where a protected species is known to occur or could possibly occur at the Site based on habitat suitability, any cleanup levels should be based on the no observed adverse effect level (NOAEL) toxicity reference value (TRV).

The dominant plant species and ecological communities were observed on and adjacent to the project site and all observed fauna was recorded and listed in the following paragraphs. Although plant species composition, density and percent cover vary throughout the project area, the on-site wetlands exist within areas that would commonly be referred to as coastal salt marshes or mudflats with moderate to low salinity levels. These plants do not fall into a precise plant community taxonomic structure, but they can be closely associated with the Saltgrass-Cordgrass, Coastal Live Oak-Redbay, and Little Bluestem-Brownseed Paspalum plant community series.

Once the Phase I data are evaluated, a site-specific habitat food web appropriate for the site will be finalized and presented in the ERA. As the media investigation progresses and RI/FS field activities occur, more information may become available regarding additional wildlife present at the site.

2.6.2.1 Soil-Related Direct Ecological Exposures

Surface soils, sediment and surface water are believed to be the primary contaminated medium. Ecological exposures to the media include ingestion (for wildlife) and direct contact (for plants and invertebrates). For birds and mammals, EPA normally considers two potentially complete soil exposure pathways: (1) incidental ingestion of soils and water during feeding, grooming, and preening and (2) ingestion of food contaminated as a result of the uptake of soil contaminants. Soil particulate inhalation and dermal contact are not included in this CSM because these pathways will contribute negligibly to risk. Specifically, inhalation of particulates will not be assessed for wildlife since respirable particles (greater than 5 micrometers) are most likely ingested as a result of mucocilliary clearance (Witschi and Last, 1996, as cited in EPA 2000d), and are already accounted for in the soil ingestion pathway for ecological receptors. In addition, at equal exposure concentrations, inhalation of contaminants associated with dust particles is expected to contribute less than 0.1 percent of total risk compared to oral exposures (EPA 2000d); therefore, dust inhalation is not included for wildlife in the CSM.

Wildlife may also be exposed to contaminants in soils via dermal contact. However, current information is insufficient to evaluate dermal exposure from contaminants in various soil matrices, or to predict possible rates of absorption for many species. For most contaminants, dermal exposure is expected to contribute less than 1 to 11 percent of the total risk compared to oral exposures (EPA 2000d).

2.6.2.2 Groundwater-Related Ecological Exposures

Currently, no complete ecological exposures to groundwater are known. Phase I will confirm the extent of groundwater impacts to fully confirm whether migration via permeable fill materials results in a groundwater to surface water discharge off-site. Nevertheless, exposure point concentrations will be developed for on-site groundwater directly beneath the Site and for off-site groundwater downgradient of the Site.

If groundwater occurs at depths of less than 2 to 10 feet, potential impacts to plant target receptors from exposure to on-site groundwater will be evaluated using two exposure point concentrations; the maximum detected and the 95% UCL concentrations. If the 95% UCL concentration exceeds the maximum detected concentration for any chemical, only the maximum detected concentration will be used as the exposure point concentration.

With the exception of shallow groundwater that may provide a source to terrestrial vegetation, the groundwater is an incomplete ecological pathway unless there is a groundwater discharge to sediment and/or surface water. Potential impacts to aquatic receptors from off-site groundwater downgradient of the Site discharging to surface water will be also be conservatively evaluated based on a completed groundwater to surface water pathway. It is assumed that aquatic receptors in Redfish bay may potentially be impacted by impacted groundwater. It is assumed that direction of groundwater flow is to the northeast from the Site towards and into the wetland areas and Redfish Bay. If the groundwater to surface water pathway is complete, two exposure point concentrations will be used to assess groundwater; the maximum detected and the 95% UCL. Again, if the 95% UCL concentration exceeds the maximum detected concentration for any chemical, only the maximum detected concentration will be used as the exposure point concentration. This exposure point concentration will be use to evaluate the total contribution of groundwater chemicals of potential ecological concern (COPECs) to the surface water taking into account the dilution of groundwater when it discharges to surface water.

In the case of groundwater contributing contaminants to sediment, this depends upon the existence of a plume and the COPECs involved and their chemistry and the media's chemistry (organic carbon, etc.) at the interface. In the screening assessment, groundwater concentrations will be evaluated as discussed previously, as will sediment concentrations. Should additional pore water data be required, then an additional sampling effort will be required to provide such data to evaluate the potential loading in the area of the release.

It is anticipated that many of the selected target receptors will be exposed through dietary intake (e.g., seeds, earthworms, fish, mammals). Since measured exposure point concentration data will not be available for dietary items, they will be predicted using uptake models. For example, an important exposure pathway for herbivorous terrestrial animals is the consumption of forage. The chemical concentrations in plants will be estimated by multiplying soil concentrations with chemical-specific plant uptake factors as available in the literature. Similar uptake models can be used to estimate chemical concentrations in other tissue types (e.g., earthworms, fish, mammals), and will be dependent on the target receptors selected for evaluation in the risk assessment.

2.6.2.3 Surface Water-Related and Sediment-Related Ecological Exposures

Immediately adjacent to the Site is a wetlands (AOC-3) that drains into Redfish Bay (AOC-5). Potential concerns are addressed in Section 2.6.2.1. Note that waters and sediments will be defined with respect to the amount of total dissolved solids measured in parts per thousand [‰]: fresh—0.5‰, brackish—0.5-30‰, salt—30-50‰ and brine—50‰. In the case of sediment the total dissolved solids are measured in the overlying water.

Potential impacts to aquatic receptors in surface water will be conservatively evaluated. As discussed above, it is assumed that aquatic receptors in Redfish Bay may potentially be impacted by the flow of contaminated groundwater into the bay, thereby impacting sediment as well as the water column.

Fish and wildlife may be exposed to fresh, brackish, or salt waters at or near the Site. As such, they may be exposed via ingestion and/or dermal contact. Wildlife (e.g., amphibians, reptiles and macrobenthos) may be exposed to contaminants in sediments via dermal contact and incidental ingestion. Surface water and sediment samples (95% UCL concentrations or maximal concentrations) will be used to evaluate potential risks to biota.

Fish also may be exposed to directly to sediments depending upon their habit. Certain fish and benthos may be exposed to contaminants entering their respective food chain; additionally, certain terrestrial wildlife may consume fish and benthos and thereby be exposed via contaminants entering their respective food chain. As mentioned above and discussed below, because measured exposure point concentration data will not be available for dietary items, they will be predicted using uptake models.

2.6.2.4 Dietary Ecological Exposures

Secondary release mechanisms may result in tertiary sources of exposure to terrestrial wildlife. Federal agencies define wetland sediments based on several attributes, including but not limited to, 'the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of the year.' The substrate in the marsh or wetlands adjacent to the Site therefore shall be treated as sediment for this RI/FS, even if it is not covered by overlying water during the entire year. This means all screening values used for comparison shall be sediment values, with the understanding that terrestrial receptors would also have to be evaluated since both aquatic and terrestrial receptors could be exposed to contaminants during periods of inundation and dry periods, respectively.
Exposures to off-site terrestrial wildlife and off-site pond wetland wildlife could be similar with regard to sediment/soil, and therefore, these two media are discussed together. Ultimately, biota that are directly exposed to contaminated media (such as earthworms that live in contaminated surface soils, or invertebrates such as snails in the off-site wetlands) may take up, or bioaccumulate, contaminants. This uptake can be important when contaminants transfer through the food web to higher trophic level consumers (such as omnivorous mammals and birds who feed on the earthworms or sediment invertebrates). Pending the true seasonality of the wetland areas, sediment invertebrates may not be present. To be conservative, biota (food chain)-related pathways were included as complete exposures for both terrestrial and wetland ecological receptors; however, sites-specific biota sampling (actual collection of plants or invertebrates, or even wildlife prey items) is reserved for Phase II of the field effort, if necessary, pending desktop modeling in the ERA process to focus the ecological COPCs for which this pathway may be complete.

2.7 CSM Summary

The CSM reflects conditions whereby soil, groundwater, sediment, and surface water may have been impacted by the release of contaminants from the former processes and activities. Little data exist for understanding the extent of contamination vertically or horizontally in soil, groundwater, sediment, and surface water. Neither future on-site human health risks nor ecological impacts to the flora and fauna of the site have been evaluated to date.

The extent of the site-related contamination in surface soil, subsurface soil, groundwater, surface water, and sediments must be determined though the use of defensible data. Since little data have been collected, this investigation is designed to be comprehensive for on-site and off-site media sampling, based on the phased approach discussed herein. As with all pathways, if the Phase I RI/FS field effort identifies previously unknown contamination that changes these or other media-based assumptions, the CSM will be updated (in the human health risk assessment [HHRA] and ecological risk assessment [ERA], as appropriate) to reflect these findings so no complete exposure pathway is left un-assessed.

3.0 SAMPLING OBJECTIVES

As stated in the DQOs for this project, the following study question, included in the Quality Assurance Project Plan, was formulated for the Site RI:

> Where do levels of preliminary COPCs exist either on or off-site at concentrations above or below risk-based screening levels (RBSLs) and/or background concentrations along complete exposure pathways for relevant exposure scenarios?

The primary objective of the FSP sampling design is to collect data of sufficient quantity and quality to resolve the study question and support risk assessment and remedy evaluation. The field sampling design is summarized in Table 2.

The goal of Phase I is to determine the nature and extent of contamination and to identify contaminant migration pathways. Data must be of sufficient quality (including acceptable reporting limits) and quantity to perform an ERA and HHRA for the site in accordance with risk assessment guidance (EPA 1991, 1997, 2000d). Additional data will be collected to support an evaluation of presumptive remedies for the site. If necessary, subsequent phases will be performed to refine the CSM and address any data gaps. Any subsequent phases will be included as addenda to this FSP.

The field sampling design (Table 2) is divided into activities that may be conducted concurrently:

- On-site OU judgmental soil sampling to assess potential hot spots, define the nature and extent of any contamination, characterize waste to allow for disposal option evaluation in the FS, and evaluate whether contaminants are migrating off-site.
- On-site OU groundwater investigation to determine the nature and extent determination of groundwater contamination. With temporary monitor well data provide data to be used in the HHRA and ERA. Data collected during the on-site groundwater investigation will also be used to update the pathway and receptor analysis presented in the CSMs, if necessary.
- On-site non-OU random-start systematic grid (random grid) soil sampling to evaluate the nature and extent of contamination, and to provide data for the ERA and HHRA.
- Off-site random grid wetlands sediment investigation to define the nature and extent of any contamination, provide data to be used in the HHRA and ERA and also be used to update the pathway and receptor analysis presented in the CSMs, if necessary.
- Off-site judgmental soil, sediment background and surface water sampling to evaluate the nature and extent of contamination, provide data for the ERA and HHRA and also to update the pathway and receptor analysis presented in the CSMs, if necessary.

The strategy for characterizing the site contamination is based on the site-specific DQOs, which are based on the following media-specific screening levels:

- EPA Region 6 human health MSSLs and TCEQ Tier 1 PCLs for human health risk screening of soil and groundwater. Groundwater ingestion pathways will only apply, upon consultation with the EPA and TCEQ, if the shallow aquifer is of sufficient yield and natural quality to constitute a potable water supply. Soil screening levels (assuming the dilution/attenuation factor of 10 as suggested by the EPA Soil Screening Level guidance document) will be used to evaluate soil-to-groundwater migration potential.

- TCEQ ecological benchmarks for ecological screening of soil, sediment and surface water.
- Texas and Federal Surface Water Quality Criteria for human health screening.
- Other applicable or relevant and appropriate requirements (ARARs).

A complete list of all human health and ecological screening levels (benchmarks) are provided in Appendix E and F.

Each of the field sampling activities and the data collection requirements are discussed in the following sections.

3.1 On-Site Judgmental Locations

A total of 43 judgmental samples (12 from the North Site and 31 from the South Site) will be collected to assess areas suspected of having had a historic release and discolored areas within former OUs (Figures 16 and 17). This area has been designated as AOC-1.

There are 12 judgmental sampling locations (J-01S through J-12S) at the North Site, to characterize possible contamination in the soil as a result of releases from product storage, pipelines, the former oil and fuel storage racks, storm water run-off, the adjoining Plains site and a former surface impoundment.

There are 31 judgmental sampling locations (J-13S through J-43S) at the South Site to characterize possible contamination in the soil as a result of releases from product storage, pipelines, drums, debris, storm water run-off, an aeration pond and spent soil placed in berms. Past releases and inspections are described in Section 2.5 of this report.

Due to the shallow depth of the groundwater, which is anticipated to be less than eight feet, two soil samples will be obtained for laboratory analysis from each boring. Samples will be obtained from the surface 0.0 to 0.5 feet and from the interval with the highest photoionization detector (PID) reading. In the event that there are no PID readings, a soil sample from the groundwater interface or at a depth of five feet will be obtained. Samples will be analyzed in a fixed laboratory for metals, VOCs, SVOCs, PCBs, and herbicides/pesticides as shown in Table 2. Each boring will be advanced a minimum of five feet below the initial contact with groundwater.

Additional judgmental samples may be added during field sampling based on field observations and/or initial analytical results.

The collection of judgmental samples results in data that are biased however due to available data the project team selected judgmental sampling for OU areas.

3.2 On-Site Random Grid Locations

The sampling objectives for non-OU on-site soil sampling include determining the nature and extent of any contamination and collecting sufficient data of appropriate quality to assess whether the Site poses risk to either human or ecological populations. Because little characterization information exists for the non-OU Sites, a 210-foot by 210-foot grid (Figure 18) has been overlain across the non-OU Site and a 140-foot by 85-foot grid (Figure 19) has been placed across the current barge dock facility, for a total of 25 grid nodes. These areas have been designated AOC-2 and AOC-4, respectively.

There are 20 random start grid sampling locations at AOC-2 (G-01S-G-20S) selected at AOC-2 by the Visual Sampling Plan (VSP), which is comprised of non OU areas of the Site that have no history of releases. Composite samples will be obtained from five adjacent samples locations resulting in four surface and four subsurface samples that will be analyzed.

The project team selected 5 random start grid sampling locations at AOC-4 (G-57S through G-61S). The locations were selected by VSP based on the history, which includes no history of releases at this AOC. Composite samples will be obtained from the five adjacent samples locations resulting in one surface and one subsurface sample from this AOC.

Although the selection of the ‘number’ of sampling locations was not based on statistics and determined by the Site Team, random-start systematic grid sampling is considered ‘unbiased’ and appropriate for application of statistics in assessing potential exposure concentrations for the HHRA and ERA. Shallow soil samples (0 to 0.5 feet bgs) will be collected at each grid location, including specific subintervals as detailed below. A second soil sample will be obtained from the 0.5 to top of groundwater interval in each boring. Soil samples from five adjacent grid nodes in AOC-2 will be composited into one soil sample (Figure 20). If a laboratory analysis results in concentrations above or near the screening level from the composite sampling then additional sampling may be recommended in Phase II of the RI/FS.

The analytical suite for the grid samples is based on the COPCs identified in Table 2. The preliminary COPCs are metals, SVOCs, VOCs, PCBs, and herbicides/pesticides.

3.3 On-Site Groundwater Locations

The objectives of the on-site groundwater investigation are to determine whether Site activities have impacted the shallow aquifer and to characterize basic hydrogeology of the site. Groundwater sampling during the Phase I investigation will be accomplished with temporary wells at locations with the greatest potential to have groundwater contamination. Temporary monitoring wells will be installed and sampled at 20 locations as shown on Figures 21 and 22. Groundwater samples collected from the temporary monitoring wells will be analyzed for metals, SVOCs, VOCs, PCBs, and herbicides/pesticides. Groundwater results obtained from the temporary monitoring wells will be used to design the permanent monitoring well network, if needed.

The planning team used judgmental sampling in the selection of the locations for the 20 temporary monitor wells (TWs), which include six at the North Site (TW01-01, TW01-02, TW01-07, TW01-08, TW01-11, TW01-12) and fourteen at the South Site (TW01-13, TW01-14, TW01-17, TW01-18, TW01-27, & TW01-33 through TW01-41). Groundwater samples will be analyzed in a fixed laboratory for metals, VOCs, SVOCs, PCBs and herbicides/pesticides as shown in Table 2. If the temporary wells demonstrate that groundwater contamination exists, a decision will be made in Phase II of the RI and permanent groundwater wells may be installed to provide additional water quality data as well as basic hydrologic data. The groundwater data will be used to evaluate human health risk via the groundwater pathway and may be used to evaluate ecological risk through groundwater discharging to surface water. Groundwater sampling will be conducted in accordance with the protocols discussed in Appendix A.

3.4 Off-Site Random Grid Locations

The sampling objectives for off-site sediment sampling include determining the nature and extent of contamination and collecting sufficient data of appropriate quality to assess whether the site poses risk to either human or ecological populations. A 455-foot by 455-foot grid (Figure 23) has been overlain across the entire wetlands, for a total of 36 grid nodes. Although the selection of the ‘number’ of sampling locations was not based on statistics and determined by the Site Team, random-start systematic grid sampling is considered ‘unbiased’ and appropriate for application of statistics in assessing potential exposure concentrations for the HHRA and ERA.

The 36 random start grid sampling locations (G-21SD through G-56SD) were selected utilizing VSP based on the data provided by the project team. Sampling will be performed to characterize possible contamination in the sediment as a result of releases from the Site and releases from pipelines in the wetlands.

Samples will be obtained from the sediments, or soils if the random wetland location is not inundated, in the 0.0 to 0.5 foot interval and will be analyzed in a fixed laboratory for metals, VOCs, SVOCs, PCBs and pesticides/herbicides as shown in Table 2. Additionally, a surface water sample will be obtained from each sediment sampling location in AOC-3 and AOC-5, before the sediment sample is taken.

3.5 Off-Site Judgmental Sampling

In addition to the grid sampling in the wetlands the project team also selected judgmental sampling (J-44SD through J-46SD, J-47S through J-53S, and J-54SD through J-58SD) in the wetlands adjacent to the underground pipelines that lead to the current and former barge dock facilities and at the sites of two documented pipeline releases in the wetlands (Figure 23). For seven of the judgmental samples in the wetlands (J-47S through J-53S), in addition to shallow sediment sampling an additional subsurface sediment sample will be obtained from each location unless those sampling locations are inundated.

The analytical suite for each judgmental sample will include all preliminary COPCs thought or known to be present at the AOC(s) associated with the judgmental sample. Table 2 summarizes the preliminary COPCs associated with each AOC.

Three judgmental sampling locations (J-59SD through J-61SD) are located in Redfish Bay to allow characterization of possible contamination in the sediment as a result of releases from the current and former barge dock facilities (Figure 24). Samples will be obtained from the sediment in the 0.0 to 0.5 foot interval and will be analyzed in a fixed laboratory for metals, VOCs and SVOCs, as shown in Table 2.

Off-site residential soil samples (AOC-6 and 7) will be collected at residential yards that lie within the greatest predicted depositional area. A total of 5 judgmental samples (3 from the Thayer Road area and 2 from the Bishop Road area) will be collected (Figures 25 and 26).

The 3 judgmental sampling locations at AOC-6 (J-62S through J-64S) will to characterize possible contamination in the soil as a result of releases from product storage, pipelines, the former oil and fuel storage racks, storm water run-off and a former surface impoundment.

There are 2 judgmental sampling locations at AOC-7 (J-65S through J-66S), to characterize possible contamination in the soil as a result of releases from product storage, pipelines, the former oil and fuel storage racks, storm water run-off and a former surface impoundment.

Background sample locations will be used to sample sediment, soil, and surface water at locations that have not been impacted by the Site and have similar characteristics to the Site's sediment, soil, and surface water (Figure 27 - Background Sample Locations).

Additional judgmental samples may be added during field sampling based on field observations and/or initial analytical results. Seven of the judgmental sample borings in AOC-3 (J-47S through J-53S) will be extended to the top of the shallow aquifer if the locations are not inundated. Samples will be collected from 0 to 0.5 foot bgs and 0.5 to the top of groundwater or 5.0 feet with additional sample intervals based on a combination of field screening techniques to include visual observations and photoionization detector (PID) results. If any of the seven locations (J-47S through J-53S) are inundated, then sediment sampling protocols will be followed at those locations. All of the other judgmental sampling locations in AOC-3 (J-44SD through J-46SD and J-54SD through J-58SD) will follow sediment sampling protocols.

The judgmental sample borings in AOC-6 and AOC-7 will be extended to the top of the shallow aquifer. Samples will be collected from 0 to 0.5 foot bgs and 0.5 to the top of groundwater or 5.0 feet with additional sample intervals based on a combination of field screening techniques to include visual observations and photoionization detector (PID) results.

The collection of judgmental samples results in data that are biased conservatively and may not be appropriate for inclusion in the site wide statistical evaluation of exposure concentrations. The judgmental samples will predominantly be used to characterize “hot spots” as needed for either the HHRA or ERA.

3.6 Off-Site Surface Water Samples

Surface water samples will be obtained at the site and analyzed for metals, VOCs, SVOCs, PCBs and pesticides/herbicides. These surface water samples will be obtained from each sediment sampling location in AOC-3 and AOC-5, before the sediment sample is taken. Additionally, surface water samples will be taken from each of the judgmental sediment sampling locations depicted in Appendix C (Additional and Revised Judgmental Sampling Locations as specified in EPA comments). The specific sampling location will be selected based on surface water conditions at the time of sampling.

The wetlands adjacent to the site are frequently dry and change configuration. Prior to sampling the RPM will be notified of the selected sampling locations.

3.7 Remedial Alternatives Evaluation

Site-specific data will be collected to evaluate presumptive remedies for any contamination of concern at the Site or off-site. Based on the information that is available no presumptive remedies have been identified.

3.8 Site Characteristics

Little data are available regarding the site stratigraphy, hydrogeology, and geotechnical properties of the soils underlying the site. Data from the adjacent Plains facility indicates that the stratigraphy is predominantly sand and groundwater is detected at depths between three to eight feet bgs. The following additional data will be collected to refine the CSM:

- Detailed stratigraphic and geotechnical information gathered with the grid and judgmental Geoprobe® drilling program and the subsequent temporary monitor well installation program;
- Information regarding the extent of the potential contaminant plumes in the uppermost and possibly deeper aquifers from monitor well samples; and

- Screening data for use in confirming the presence of preliminary COPCs collected from soil borings, and

- Definitive groundwater data collected from monitor wells that can be used to support a risk assessment and FS.

Definitive groundwater data collected from monitoring wells will be used to support the risk assessment and feasibility study.

4.0 FIELD INVESTIGATION

This section describes the field investigation activities to be performed during the RI at the site, including the rationale for the various field activities and the number of samples that will be collected.

Samples will be analyzed by Accutest Laboratories using appropriate analytical methods for the isolation, detection, and quantitation of specific target compounds and analytes. The applicable analytical methods (e.g, EPA SW-846 or equivalent) are referenced in the FSP and QAPP.
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4.1 Utility Clearance and Site Reconnaissance

The initial site reconnaissance and characterization will be performed in accordance with Kleinfelder’s standard operating procedure (SOP) No. 1.0. The site reconnaissance and characterization will include site and utilities identification; and a topographic survey, including easements, site surface features, and rights-of-way.

4.2 Geologic Investigation

The soil investigation includes an evaluation of surface and subsurface soils with regard to the nature and extent of contamination. On-site judgmental sample locations are shown on Figures 16 and 17 and on-site random grid sample locations are shown on Figures 18 and 19. Field sample locations are subject to field verification, and may be adjusted due to utilities, accessibility, etc.

All soil data determined to be usable for risk assessment will also be used in the HHRA and ERA. The on-site Phase I investigation includes the evaluation of soil and groundwater from the surface to the shallow aquifer, at a depth of approximately 12 feet bgs.

4.2.1 On-Site Surface Soil Sampling

Surface soils refer to those soils from the ground surface to 0.5 feet bgs. To characterize soil at all locations (including those planned sample locations presently below concrete or asphalt), and to ensure samples may be used to characterize future on-site risks assuming present ground cover will change, underlying soil will be accessed through 6-inch-diameter core holes, where necessary to access soils beneath concrete or asphalt.

Surface soil will be collected with either a (1) drive sampler lined with acetate sleeves device using Geoprobe® equipment or (2) hand sampling device, such as a soil hand auger or manual drive sampler.

Figure 28 illustrates the sampling profile and sampling design for both judgmental and grid sample locations. Soil samples for nature and extent of contamination will be collected from depths determined in the field, based on lithologic characteristics and screening techniques. In some AOCs, nature and extent will be evaluated by both grid and judgmental boring locations.

4.2.2 On-Site Judgmental and Random Grid Surface Soil Samples

Judgmental samples will be located at 43 judgmental sample locations in AOC-1 to address potentially contaminated areas that were identified in previous investigations and from on-site inspections.

The sampling interval will be 0 to 0.5 foot bgs, all samples will be field-screened with a photoionization detector (PID) and 100 percent of the judgmental samples will be submitted to the fixed laboratory for the analyses detailed in Table 2.

On-site random grid samples at AOC-2 and AOC-4 (on-site non-OU and barge dock facility) will be obtained, properly stored and then five adjacent grid modes will be composited into one sample that will be analyzed at a fixed laboratory. As a result, four surface soil random grid samples will be analyzed from the on-site non-OU area and one composite sample from the barge dock facility will be analyzed.

4.2.3 On-Site Subsurface Soil Sampling

Subsurface soils refer to those soils from depths greater than 0.5 feet bgs. Subsurface soil samples will be collected with a drive sampler lined with acetate sleeves using Geoprobe® equipment at 43 judgmental locations and 25 grid node locations.

Subsurface soil samples will undergo the same sample preparation procedures outlined for surface soil samples.

Judgmental and random grid location Geoprobe® borings will be extended five feet into the shallow aquifer to evaluate. Based on preliminary borings and off-site geologic information, depth to water is anticipated to be between two and 12 feet bgs.

Lithologic core samples will be collected to evaluate surface and subsurface soil conditions as well as profile the unsaturated zone. Figure 28 illustrates the subsurface soil profile and sampling design for both grid locations and judgmental sample locations.

One subsurface soil sample will be collected at each grid location Geoprobe® boring from the interval with the highest PID reading or other indication of contamination recorded. In the event that no evidence of contamination is noted, the sample will be collected from the groundwater interface. Each sample will be field-screened and submitted to the fixed laboratory for analysis of metals, SVOCs and VOCs. As noted in Table 2, some samples will be analyzed for PCBs and herbicides/pesticides.

4.3 On-Site Groundwater Sampling

A groundwater investigation is required to determine basic hydrogeological properties and potential contamination of aquifers underlying the site. During the judgmental-based Geoprobe® investigation, temporary monitoring wells will be installed and sampled at approximately 20 locations within AOC-1 immediately following soil sample collection.

After the water level has stabilized, samples collected from temporary wells will be filtered using disposable 45-micron filters due to the expected high turbidity of groundwater from undeveloped temporary wells. The temporary wells will be analyzed for VOCs, metals and SVOCs and some will be analyzed for PCBs and herbicides/pesticides as indicated inTable 2. After groundwater sampling from the temporary well is completed, the Geoprobe® subcontractor will remove the temporary well casing and screen at the direction of Kleinfelder and grout each boring from termination depth up to ground surface with a cement/bentonite mix. Groundwater physical and chemical data collected from temporary monitoring wells will be used to design the placement of permanent monitoring wells, if any.

If contamination is detected in the shallow aquifer temporary wells, taking into consideration the DQOs for the groundwater investigation set forth in the QAPP, up to 20 permanent monitoring wells will be installed in the shallow aquifer. The DQOs include decision criteria, including specific step-wise logic. If temporary well results indicate that contaminants are detected above or near the appropriate screening levels, permanent monitoring wells may be installed to assess representative concentrations and trends. These decisions will be made during the scoping meeting after the completion of Phase I. Post-development groundwater samples collected from permanent monitoring wells will not be filtered and will be analyzed for metals, VOCs, SVOCs and PCBs. Depending on the preliminary COPCs present and the magnitude of concentrations detected in the shallowest aquifer, additional investigation to the next deeper aquifer (for vertical nature and extent) may or may not be indicated. Specifically, the detection of naturally occurring inorganics in the shallowest aquifer is to be expected, and deeper investigation of the next aquifer may not be indicated unless significant exceedances of appropriate (based on unit classification) screening levels are detected in permanent monitoring wells.

If well data indicate that no site-related COPCs have been detected or otherwise do not meet the DQO decision criteria, then no permanent monitor well may be installed. Further delineation of groundwater contaminants will be reserved pending Phase II discussions concerning the results of the Phase I shallow aquifer assessment.

After reviewing groundwater data from the temporary monitoring wells, a location or locations for upgradient monitor wells to establish background levels will be determined (if needed) based on onsite shallow aquifer exceedances of appropriate MSSLs and other DQOs.

If the shallow aquifer is contaminated, the underlying water-bearing zones (WBZ) may need to be evaluated to determine impacts if (1) hydrogeological connections are suspected and (2) the contaminant fate and transport characteristics indicate a potential for downward migration. If these conditions are satisfied, the horizontal extent of contamination will have to be determined. Deeper WBZs will be evaluated further, in Phase II, if chemicals are detected in overlying WBZs, whether above or below appropriate MSSLs or chemical specific applicable or relevant and appropriate requirements (ARARs), considering groundwater classification. The WBZs below the shallow aquifer will be evaluated, if necessary, during the Phase II investigation.

4.4 Off-Site Sampling

Off-site field activities will include the following:

- Obtaining access agreements;
- Sampling sediment in the wetlands and bay adjacent to the Site;
- Sampling soil in residential areas; and
- Sampling at background locations.

Each off-site sampling activity is discussed in the following sections. The sampling intervals and analytical suites at each off-site sampling location are summarized in Table 2.

4.4.1 Obtaining Access Agreements

Access agreements will be obtained for all off-site sampling locations. Prior to contacting each landowner, Kleinfelder will determine property ownership by searching tax records located at the San Patricio County Appraisal District website and looking at past access agreements obtained by the TCEQ. In the event that a property has a tenant, an access agreement will be obtained from the owner and the tenant. If the property resident(s) is non-English speaking, Kleinfelder will return to the residence at a later time with an interpreter to explain and obtain the access agreement.

Kleinfelder personnel will always conduct site visits to areas with residences with at least two employees. Kleinfelder personnel will give the property owner/tenant a copy of a form letter approved by EPA that states the reason for the sampling and requests access. The access letter will include at a minimum the following:

- EPA contact and phone number for questions;
- Estimated time frame for sampling;
- Beginning and ending date for the access agreement; and
- The signature of the project coordinator or an appropriate EPA official.

During the property visit to obtain access, Kleinfelder personnel will also provide the property owners/tenants with a Kleinfelder phone number for questions. This phone number will also be used as a call back number for residences where the occupants were not at home. The

Kleinfelder phone line will be activated prior to the start of field activities and used for correspondence with property owners/tenants and other tasks associated with the off-site field activities. The phone will have a 24-hour message recorder that will be monitored daily during off-site field activities. If no one is home, a letter will be left.
At each property, Kleinfelder personnel will request that the property owner (and tenant, if applicable) sign the access agreement. During the property visit, Kleinfelder personnel will interview the owner using a pre-prepared, standardized questionnaire. The questionnaire will be prepared prior to the start of field activities and submitted to EPA for approval. It will include the following questions:

- Where are vehicles usually and historically parked?
- Do children usually play on the property? If so, where?
- Has fill material been placed anywhere on the property? If so, what was the source of the material and where and when was it placed?
- Are there any dogs or other animals that may limit access to the property?
- Are there any locked gates or other restricted access areas?
- Is there a garden on the property?

Kleinfelder will provide relevant details on home construction, including approximate year of construction and type of structure (frame with crawlspace, brick on slab, etc.). During the interview, Kleinfelder employees will complete the questionnaire/data sheet as the residential profile. Following the brief interview, Kleinfelder employees will sketch a property layout map to include the following:

- Fences;
- Structures;
- Fill material;
- Gardens;
- Children play areas;
- Vehicle parking areas; and a
- Brief description of the structure

A property folder will be maintained for each property. The property folder will contain the following:

Copy of a letter describing the reason for the request and asking for access;

- Tax record print out;

- Signed access agreement;
- The short questionnaire/data sheet completed by Kleinfelder;
- Aerial photographs with site features;
- Property drawing and any additional maps, if applicable;
- Copies of all correspondence related to the property;
- Copy of field sampling sheet;
- Copies of log book pages documenting sampling at the location; and
- Copy of sample results related to the property.

4.4.2 Background Sampling

The preliminary COPCs at the site are inorganic and organic contaminants that may be both (1) naturally occurring in geologic formations and (2) anthropogenic (man-made) contaminants resulting from the Site and from adjacent facilities.

Background sampling has three goals, including providing data for (1) comparison of COPCs in surficial soils; (2) establishing attribution, via establishing either the absence or low-level (naturally occurring) concentrations of indicator or signature inorganics that may have been released from the Site; and (3) establishing site-specific background concentrations for application to both the off-site residential investigation as well as the on-site surface soil investigation.

To meet these goals, four soil, four sediment, and four surface water background samples, as noted in Table 2, will be collected from like areas believed to be unimpacted by Site operations. The areas were selected based on similar soil, sediment, and surface water types to AOC soil, sediment, and surface water (Figure 27).

At each of the locations, a sample will be obtained and sampled for metals, VOCs, SVOCs, PCBs and pesticides/herbicides.

4.4.3 Off-Site Sediment and Surface Water Sampling

The RI will include an investigation of sediment and surface water in the adjacent wetlands (AOC-3) and in Redfish Bay (AOC-5). Sediment/soil in the wetlands will be sampled with both random grid and judgmental samples. The judgmental sampling will be performed along the pipeline that connects the refinery to the current and historic barge dock facilities, the barge dock facilities on the Intracoastal Canal, the wetlands in AOC-3, the locations of known pipeline releases in the wetlands, and at the culvert outlet draining into the Intracoastal Canal.

The sediment samples from Redfish bay will be judgmental to determine if there are COPCs associated with the current and historic barge dock facilities and the culvert draining into the Intracoastal Canal. Surface water samples will also be obtained from each of the sediment sampling locations.

Surface water samples will be obtained from each of the sediment sampling locations in AOC-3 and AOC-5.

In each sampling point, a conscious effort will be made to sample surface water without disturbing sediment (and in that sequence, with surface water collected prior to sediment collection) will be made. The surface water samples will be collected using a coliwasa, long-handled dipper, or submerged sample jar. All surface water samples collected for VOC analysis will be placed in sample containers with zero headspace. No stratification of the dissolved phase surface water is expected, based on the preliminary class of COPCs and the depths of the ponds, so sampling from the most accessible surface of the ponds meets the DQOs for the vertical boundaries of the on-site surface waters.

Sediment samples will be collected from the top 0.5 foot using a hand core sampler driven with a slide hammer, long-handled dipper, or other suitable sampling device as site-specific conditions warrant.

Sediments will be analyzed for preliminary COPCs outlined in Table 2.

5.0 SAMPLE DESIGNATIONS

Each sample obtained in the field will be designated with a unique alphanumeric designation according to the following sample classifications.

5.1 Judgmental Sample Designation

Judgmental samples include Geopobe® soil samples, possible surface soil samples collected with a hand auger or via other means and sediment samples. The judgmental sample designation will include three fields that are separated by dashes, for example: J-03S-0.0-0.5.

- The first field**, "**J-03S," identifies the judgmental sample number. The first alpha characters is the designation for judgmental sample (J). The numerical characters that follow J are the distinct number for that judgmental sample location and the alpha characters that follow the number indicate that the sample is a soil sample (S). If the sample is a sediment sample the designation SD will be used.
- The second field, "0.0," represents the top of the sample interval measured in feet bgs.
- The third field, "0.5," represents the bottom of the sample interval measured in feet bgs.

5.2 Grid Sample Designation

Geoprobe® soil samples will be collected at grid nodes from a grid system of 210-foot-square units in AOC-2 and sediment samples will be obtained from a 455-foot square grid in AOC-3. The grid sample designation will include three fields that are separated by dashes, for example: G-01S-4.0-4.5.

- The first field, "G-01S," identifies the grid sample number. The alpha character is the designation for grid sample (G). The numerical characters that follow G are the distinct number for that random grid sample location and the alpha characters that follow the number indicate that the sample is a soil sample (S). If the sample is a sediment sample the designation SD will be used.

The second field, "4.0," represents the top of the sample interval measured in feet bgs.

The third field, "4.5," represents the bottom of the sample interval measured in feet bgs.

5.3 Groundwater Sample Designation

Groundwater sample designations will include separate nomenclature for samples collected from temporary monitoring wells and permanent monitoring wells.

Temporary wells will be installed at locations shown on Figures 21 and 22. For temporary wells, groundwater sample designations will include two fields separated by a dash, for example:

TW01-05. The first field, “TW.” identifies the sample as having been collected from a temporary well and “01” identifies the AOC. The second field, “05,” represents the numerical designation for the temporary well number.

Permanent monitor well (MW) groundwater sample designations will include two fields that are separated by a dash for example: MW01-05. The two alpha characters in the first field, “MW01,” identifies the sample as having been collected from a permanent monitoring well and “01” identifies the AOC. The second field**, “**05,” represents the numerical designation for the permanent monitor well number.

There are no plans during Phase I to investigate deeper aquifers. However, if it becomes necessary to sample deeper aquifers during Phase II operations then an additional field will be added to the sample designations to show which aquifer is being assessed.

5.4 Surface Water Sample Designation

Surface water samples will be collected from the wetlands and Redfish Bay. The surface water sample designation will include two fields that are separated by a dash, for example: SW-01. The two alpha characters in the first field, “SW,” identifies the sample as a surface water (SW) sample. The second field, “01,” represents the numerical designation of the surface water sample.

5.5 Background Soil Sample Designation

Field background samples will be identified by “BG” followed by a sequential number. The background sample designation includes three fields that are separated by a dash, for example: BG-01S-0.0-0.5. The first field, “BG,” identifies the sample as a background (BG) sample followed by “01,” which represents the numerical designation of the sample. The alpha characters that follow the number indicate that the sample is a soil sample (S). If the sample is a sediment sample the designation SD will be used. The second field, “0.0,” represents the top of the sample interval measured in feet bgs. The third field, “0.5,” represents the bottom of the sample interval measured in feet bgs.

5.6 Field Duplicate Sample Designation

Field duplicate samples will be identified by adding a “D” to the end of the sample designations described above; for example, TW01-05D or MW01-05D and J-03S-0.0-0.5D.

5.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Sample Designation (for organic analyses)

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) organic samples will be identified by adding an “MSD**”** to the end of the sample designations described above, for example: MW01-05MSD and J-03S-0.0-0.5MSD.

5.8 Matrix Spike/Matrix Duplicate (MS/MD) Sample Designation (for inorganic analyses)

MS and Matrix Duplicate (MD) inorganic samples will be identified by adding an "MD**"** to the end of the sample designations described above, for example: MW01-05MD and J-03S-0.0-0.5MD

5.9 Trip and Equipment Blank Sample Designation

Trip and equipment blank samples will be identified sequentially beginning with TB-1 and EB-1, respectively.

6.0 SAMPLING EQUIPMENT AND PROCEDURES

This section describes the equipment and procedures required during each RI activity.

The following text provides the sampling team with the necessary information to collect samples at the site. When an RI activity is addressed in an SOP, the text references the SOP and discusses modifications to the SOP that are required by site-specific conditions. A list of SOPs that will be used in the RI is included in Table 3. Copies of the SOPs are maintained in Kleinfelder offices and are available in electronic file format, if necessary. Appendix B includes the forms that will be used during field activities.

6.1 Mobilization

Initial field activities, including (1) obtaining off-site access, (2) clearing utilities, and (3) locating temporary facilities, are discussed below.

6.1.1 Obtaining Off-Site Access

Field activities will be conducted both within and beyond the boundaries of the Site; therefore, Kleinfelder will arrange access to surrounding off-site properties. Residents, property owners, or their designated agents will be notified at least 1 week before field activities are expected to occur in their area, and after the access agreements have been obtained.

6.1.2 Clearing Utilities

As part of mobilization activities, reasonable measures will be undertaken to locate underground utilities, and any marked pipeline and fiber optic and telephone lines before subsurface sampling begins. This will include contacting the City of Ingleside and Texas One-Call services. The location of the underground utilities may also require subcontracting a local underground line locator service to locate main underground utility lines. No intrusive work will commence until utility locations are identified.

6.1.3 On-Site Facilities

Kleinfelder will identify and provide all necessary personnel, equipment, and materials for mobilization and demobilization to and from the site to conduct each task of the field investigation. The Kleinfelder Site office at the refinery will be used for the staging area of all activities.

6.2 Site Reconnaissance

The initial site reconnaissance and characterization will be performed in accordance with Kleinfelder SOP No. 1.0. The site reconnaissance and characterization will include (1) a survey of pertinent site and surrounding features including land use and habitats and (2) an off-site well receptor survey.

Off-Site Well and Receptor Survey

If on-site groundwater is contaminated, all residential, industrial, and agricultural wells within a 1-mile radius of the site will be identified to determine any potential receptors of contaminated groundwater migrating off-Site. Kleinfelder will use prior data to determine the locations of the potential receptors.

Kleinfelder will prepare written documents to contact well owners. The documents will request verification of the existence of the well, the exact well location, well depth, screened interval, well use, pumping rate, pumping schedule, and available water quality information.

The results of the off-site groundwater receptor survey will be tabulated, and the well locations will be plotted in relation to the site on an area map to be presented in the RI report. In the event that domestic wells are identified within the radius of interest, water samples will be collected from the wells.

6.3 Geologic Investigation

This section describes the equipment and procedures that will be used during sampling activities. Kleinfelder will arrange for daily delivery of samples from the site to the appropriate laboratories. Kleinfelder does not anticipate that equipment and vehicle noise and dust suppression will become a concern during the Phase I RI; these concerns are more typical of remedial action activities rather than an RI. Information pertaining to each sample will be logged on a separate field sheet. An example of a sample field sheet is included in Appendix B. Air monitoring for site worker safety is addressed in the site-specific health and safety plan.

6.3.1 Soil Sampling

Soil samples will be collected using Geoprobe® technology as defined in SOP No. 42 or using a stainless-steel hand-coring device as defined in SOP No. 5. For each Geoprobe® boring, the sample rods will be advanced by hydraulically driving the drive sampler lined with acetate sleeves to the desired sample collection depth. Intervals requiring larger sample volumes will be collected with a 2-foot long by 2.5-inch diameter split spoon sampler. Intervals requiring smaller sample volume will be collected with a 4- or 5-foot long by 1.5-inch core barrel lined with acetate sleeves.

An experienced professional geologist will describe and log the collected soil samples in accordance with the Unified Soil Classification System (USCS). Samples will be screened in the field using a PID for volatile organic vapors and recorded on the field-boring log.

A boring log will be completed for each boring according to SOP No. 8. After sampling is completed at each location, the boring will be filled to the ground surface with a bentonite and grout mix as specified in TCEQ regulations. Temporary monitoring wells will be installed in selected borings and sampled prior to abandonment.

6.3.2 Sediment Sampling

Wetland and Redfish Bay sediments will be collected with a hand core sampler, slide hammer sampler, or long-handled dipper. These samples will be collected as site-specific conditions warrant. Sampling will be performed according to SOP No. 32, depending on site-specific conditions.

6.3.3 Surface Water Sampling

Surface water samples will be collected from the wetland and Redfish Bay in accordance with SOP No. 21. Grab samples will be collected using a, coliwasa, or long-handled dipper, or directly into submerged sample containers to collect a representative water sample from the water column.

The location of the sample will depend on site circumstances.

6.4 Hydrogeologic Assessment

This section describes the equipment and procedures for investigating the hydrogeology at the site.

6.4.1 Monitor Well Installation

Temporary monitor wells will be installed during the field investigation using Geoprobe® technology.

6.4.1.1 Temporary Monitoring Wells

Temporary monitoring wells will be completed by a licensed State of Texas driller (Geoprobe® subcontractor), in accordance with applicable state requirements. Kleinfelder will log each boring according to the USCS and prepare a well construction diagram for the temporary monitoring well. The following general requirements will be adhered to during well installation:

- Monitoring well casing materials:
    - Casing will be new, 1-inch-diameter, Schedule 40 polyvinyl chloride (PVC), flush threaded and in 5-foot and 10-foot lengths;
    - The bottom of each well will be sealed with a flush-threaded end cap; and
    - Casing materials will be installed to ensure that the wells are plumb and correctly aligned.
- Monitoring well screen materials

    - Screen will be new, 1-inch-diameter, Schedule 40 PVC, flush-threaded and in 5-foot and 10-foot lengths;
    - The screen will be constructed of factory-slot, 0.010-inch size;
    - The bottom of each well will be sealed with a flush-threaded end cap; and
    - Screen materials shall be installed to ensure that the wells are plumb and correctly aligned.
- Monitoring well filter pack materials
    - The filter pack will consist of 20-40 mesh sand and will be placed at depths specified by the Kleinfelder geologist;
    - The filter pack material will be slowly poured outside the well casing;
    - The depth to the top of the filter pack will be periodically measured; and
    - If settling occurs, additional filter pack material will be added.
    - The Geoprobe® subcontractor will continuously monitor the depth of the filter pack with a weighted measuring tape.
- Well seal materials

A bentonite-slurry grout or small-diameter bentonite chips, at the direction of Kleinfelder personnel, will be installed in the boring from the top of the filter pack to ground surface.

Surface completions will not be required for temporary monitor well installation. The depth to water from the top of casing will be measured. The elevation of the top of casing will be recorded with a Global Positioning System (GPS) unit. After groundwater sampling from the temporary well is completed, the Geoprobe® subcontractor will remove the temporary well casing and screen at the direction of Kleinfelder, and grout each boring from termination depth up to ground surface with a cement/bentonite mix.

6.4.1.2 Permanent Monitoring Wells

Based on the results from the temporary monitor wells, permanent monitor wells may be installed in the shallow aquifer by drilling soil borings using hollow-stem auger drilling methods (SOP No. 17). Soil samples will be continuously collected with split-spoon or Shelby tube sampling devices and soil samples extruded in the field will be logged and described by a Kleinfelder field geologist in accordance with USCS terminology and appropriate Munsell® color chart designations. A soil-boring log will be completed for each boring (Appendix B).

The following monitor well installation procedures will be used in accordance with SOP No. 9:

- Well screen material will be flush threaded, 2-inch American Society for Testing and Materials (ASTM) schedule 40 PVC with machine-cut 0.010-inch slots;
- All casing will be received in original factory packaging.

- Screens may be 2½, 5, or 10 feet long.
- The bottom of each well will be sealed with a flush-threaded end cap;
- Casing and screen materials will be installed to ensure that the wells are plumb and correctly aligned;
- The annulus around the well screens will be completed with 20/40 silica sand to 2 feet above the well screen and emplaced to ensure complete coverage and settling;
- The contractor will surge block sand to ensure proper settling;
- After surging, more sand will be added if necessary;
- A 3-foot-thick sodium bentonite seal will be placed directly above the filter pack;
- The seal will be composed of commercially manufactured, small-diameter bentonite pellets;
- The bentonite pellets will be placed into the borehole and hydrated before the rest of the well annulus is sealed;
- The drilling subcontractor will also confirm the proper depth of the bentonite seal with a weighted measuring tape;
- An annular seal will be placed above the 3-foot bentonite seal;
- The annular seal will be a cement grout consisting of a mixture of Portland cement (ASTM C 150), bentonite, and water;
- The grout composition will consist of about 7.5 gallons of water, 4 pounds of bentonite, and one 94-pound bag of cement;
- Monitor wells will be completed above grade with a locking steel shroud, rising at least 3 feet above grade, set in 4-foot by 4-foot by 6-inch thick, 3,000-pound-per-square inch concrete;
- Based on field conditions, flush mount well completions may be chosen;
- Depending on field conditions and well location, four bollards may be placed around the well pad of the above grade monitoring wells;
- Bollards will be steel pipe, 4-inch nominal diameter, set in a 2-foot-deep by 8-inch-diameter posthole foundation;
- The posthole and bollards shall be filled with concrete to grade and the top of the bollard, respectively;
- A locking well cap will be installed on each well casing. All locks will be brass (non-rusting) and keyed to the same combination;
- After the boring annulus is filled with grout, a water sample will be obtained and the pH will be measured in the field;

- A pH reading of 12 or higher may indicate an invasion of grout into the well. If this occurs, the well will be plugged and abandoned and a new well will be installed;
- A well completion diagram form will be completed for each well (a sample form is included in Appendix B); and
- Kleinfelder will describe all well materials and quantities used in the field logbooks.

6.4.1.3 Monitor Well Development

Permanent monitoring wells will be developed between 24 hours and 7 days after completion and temporary monitoring wells will not be developed. The following is a summary of the procedures for well development:

- Wells will be developed using a combination of mechanical surging and pumping. This process may be supplemented (for a maximum of 3 hours) using a bottom discharge/filling bailer to remove sediment.
- Temperature, pH, conductivity, and turbidity will be monitored during surging and pumping (one reading per well volume). Surging and pumping will continue until these parameters stabilize (less than 0.1 pH units, less than 1 degree Celsius, or a 10 percent change for the other parameters between three consecutive readings) and the water is free of turbidity defined as a nephelometric turbidity unit reading of 10 or less.
- If the parameters have not stabilized after 3 hours, development will cease with the well recorded as developed.
- All development water will be contained for appropriate characterization and disposal.
- All development information will be recorded on a well development form that will be completed for each well.

6.4.1.4 Obtaining Potentiometric Surface Data

Depth to water (DTW) will be measured in both temporary monitoring wells and permanent monitoring wells. A complete round of water levels will be collected during a 24-hour period after all temporary wells have been installed.

DTW will be measured in all permanent monitoring wells no sooner than 24 hours after well development. The DTW will be measured with an electronic water level meter from a referenced survey point on the top of the north side of casing. Water levels will be measured to the nearest 0.01-foot, and consecutive measurements will be made until successive readings are in agreement within 0.01 foot.

6.4.1.5 Monitor Well Sampling

Groundwater samples collected from temporary wells will be filtered using disposable 45-micron filters due to the expected high turbidity of groundwater from undeveloped temporary wells. Groundwater data collected from temporary monitoring wells will be used to design the placement of permanent monitoring wells, in needed.
One complete round of groundwater samples will be collected after the new permanent monitoring wells have been installed. The permanent monitoring wells will be sampled using low-flow sampling procedures in accordance with SOP No. 10 and as described above. Dedicated equipment will be used for each permanent monitoring well.

6.5 Aquifer Testing

Depending upon initial analytical results, either single well aquifer tests and/or slug tests may be performed on a number of wells at the Site. Constant rate single well pumping tests will be performed as follows:

- Install a pump with a capacity between 1 and 20 gallons per minute (gpm) at 100 feet of total head in the pumping well and connect to controller and generator;
- Rout conveyance piping into 55-gallon drum. The water will be transferred to the on-site 500-gallon storage tank for disposal;
- Set initial pumping rate at 1 gpm;
- Manually gauge drawdown in the pumping well.
- Continue pumping at constant rate for 2 hours then terminate pumping; and
- Manually gauge recovery of the pumping well. Gauge recovery for 1 hour or until the water level recovery in the pumped well has recovered to 95 percent of static.

The drawdown data will be analyzed using the straight-line method of Jacobs and recovery data by the Theis recovery method. In the event that sustainable yields are not obtainable, slug tests will be performed in select monitor wells to estimate the local hydraulic conductivity of the screened portion of the aquifer.

Slug tests will be performed by causing a sudden change in the water level in the well and then measuring the water level recovery rate. Slug tests will be accomplished with a solid slug used to displace water in the well.

For the falling head test, the slug will be rapidly lowered into the well, thereby causing the water level in the well to rise. The dissipation of the induced head will be recorded with a data logger until the water level in the well returns to static. For the rising head test, the slug will be rapidly removed from the well to lower the water level in the well. The recharge to the well in response to the induced head will be similarly recorded.

Water levels will be measured immediately prior to the aquifer test and recorded throughout the recovery periods until water levels have recovered to within approximately 95 percent of the static water level.

The slug test data will be analyzed using AQTESOLV analysis software. Since little basic hydrologic information is presently available, the exact method of analysis will be determined after evaluating data collected from boreholes and site monitoring wells.

An additional evaluation of the aquifer yield will be performed by pumping select wells for 24 hours at a low flow rate (approximately 0.1 gpm, equal to 150 gallons per day). The purpose of these tests is to assess whether the yield of the shallow water-bearing zone at the site is sufficient to classify it as a Class III aquifer in the state of Texas.

6.6 Monitor Well Survey

After any permanent monitoring wells are installed, a licensed land surveyor will survey the locations and elevations of the monitoring wells. The latitude, longitude, state plane coordinates, and elevations relative to the National Geodetic Vertical Datum (NGVD) will be determined for each monitoring well. Well completion forms will then be completed and submitted to the State of Texas.

6.7 Decontamination

Equipment decontamination will be conducted in accordance with SOP No. 11. Before undertaking any sampling activities, the Geoprobe® and drilling subcontractors will construct a decontamination pad for equipment used at the site at locations designated by Kleinfelder. Reusable sampling equipment used for collecting water, soil, and sediment will be decontaminated between uses.

All reusable equipment used to collect, handle, or measure samples will be decontaminated in accordance with SOP No. 11. The decontamination procedure will match the degree of contamination on the sampling equipment. Equipment will be decontaminated at the designated decontamination area for each sampling team. All items that will come in contact with potentially contaminated media will be decontaminated before each use. If decontaminated sampling equipment is not used immediately, it will be covered with plastic. All decontamination episodes and deviations from decontamination procedures will be recorded in the designated field logbook.

The general decontamination procedures for equipment include (1) steam cleaning, pressure washing, or scrubbing all sampling devices with Liquinox® and water to remove dirt; (2) thoroughly rinsing them with tap water; and (3) a final rinse with deionized water.

One equipment rinsate blank will be collected per nondedicated tool type per day, or 1 for every 20 samples collected.

6.8 Investigation Derived Waste (IDW)

An IDW accumulation area will be used for the temporary storage of field-generated waste, such as soil cuttings, drilling fluids, decontamination water, and purged water. All waste will be properly labeled, sampled, and inventoried for future disposal. Kleinfelder will manage and track all IDW. The wastes will include discarded materials resulting from field activities that, in their present form, possess no inherent value or additional usefulness without treatment. The wastes will be divided into solids, liquids, and personal protective equipment (PPE).

To ensure the appropriate disposal of IDW, a tracking system will document the information necessary to determine the amount of contamination present in the waste. Waste tracking will be performed by the Kleinfelder on-site project manager and includes the following activities: segregation by waste type, waste container labeling, waste container movement, waste container storage, and waste disposal.
Solid waste (drill cuttings) will be temporarily stored at the site on high-density polyethylene (HDPE) and covered with HDPE pending characterization and disposal. Liquid waste will be contained in a HDPE tank pending characterization and disposal. All IDW will be placed in locked areas overnight.

Samples of solid waste will be collected for characterization and disposal. All disposable Personal Protective Equipment (PPE), including Tyvek coveralls, gloves, and booties will be decontaminated and disposed of as nonhazardous waste or will be contained in 55-gallon drums and left on site for later disposal.

Soil and liquid waste will be characterized and disposed of in accordance with local, state, and federal regulations. If a waste is nonhazardous, it will be disposed of at a nonhazardous landfill. If analytical data demonstrate that a waste must be classified as hazardous, disposal options will be evaluated by Kleinfelder and approved by the EPA

7.0 SAMPLE HANDLING AND ANALYSIS

This section describes sample handling, sample analysis, quality control (QC) requirements, field instrumentation, and data management.

7.1 Sample Handling

This section describes the sample handling procedures required for sample tracking and analysis.

7.1.1 Sample Container, Volume, Preservatives, and Holding Time Requirements

Table 4 specifies the required sample volume, container type, preservation technique, and holding time for chemical analysis and includes information for organic, inorganic, and general chemistry parameters for both aqueous and solid samples. Required containers, preservation techniques, and holding times for field QC samples (such as duplicates, field blanks, trip blanks, MS/MD, and MS/MSDs) are the same as for investigative samples.

7.1.2 Sample Management and Tracking

Each sample will be traceable from the point of collection through analysis and final disposition to ensure sample integrity. Kleinfelder will use standard EPA procedures to identify, track, monitoring, and maintain chain of custody for all samples.

A field sampling sheet will be completed for each sample collected. The field sampling sheet will be signed by the sampler and delivered to the command post with the sample. At the command post, data managers will generate a chain-of-custody for samples going off site for laboratory analysis.

7.2 Sample Analysis

This section describes the analytical procedures for samples collected during field activities at the site. Table 5 lists the laboratory analytical methods. In all cases, appropriate methods of sample preparation, cleanup, and analysis are based on specific analytical parameters of interest, sample matrices, and required detection limits. EPA-approved analytical methods were taken from EPA guidance documents.

Kleinfelder will follow the analytical services request procedures outlined in the QAPP. Analytical procedures are included in the QAPP. Kleinfelder will require that the laboratory chosen to perform the analytical work for the Site acquire the lowest possible COPC quantitation limits to evaluate the data against human health and ecological risk-based screening levels.

When EPA-approved methods are not available or appropriate for project-specific requirements, other recognized standard analytical methods, such as those published by the American Society for Tests and Measures (ASTM) or the National Institute for Occupational Safety and Health (NIOSH) may be used.

7.3 Quality Control

Various types of field and laboratory QC samples and measurements will be used to verify that analytical data meet the quality assurance objectives and to assess how sampling activities and measurements influence data quality. Similarly, laboratory QC samples will be used to assess how a laboratory's analytical program influences data quality. This section describes the QC samples for each field and laboratory environmental measurement method and each sample matrix type. Table 6 presents the frequency that QC samples are to be collected. Detailed procedures are included in the QAPP.

Field QC samples will be collected and analyzed to assess the influence of sampling activities on data quality. These samples include trip blanks, field blanks, equipment rinsate blanks, field duplicates, MS/MSDs, and MS/MDs. MS/MSD and MS/MD samples are laboratory QC samples for organic and inorganic analyses, respectively, that may require extra sample volumes to be collected in the field. Field QC measurements may include field replicate measurements and checks of instrument responses against QC standards.

Trip blanks assess the potential for sample contamination during handling, shipment, and storage. Trip blanks are sample bottles filled with organic-free water that are prepared off site. They are sealed and transported to the field; kept with empty sample bottles and then with the investigative samples throughout the field effort; and returned to the laboratory with the investigative samples for analysis. Trip blanks are never opened in the field. The trip blank is analyzed for VOCs only.

Equipment rinsate blanks are collected when reusable devices, such as trowels and bailers, are used to collect samples. These data are used to assess the cleanliness of the sampling equipment and the effectiveness of equipment decontamination. Equipment rinsate blanks are collected by pouring analyte-free water over the surfaces of sampling equipment that contacts sampling media. Equipment rinsate blanks are collected after sampling equipment has been decontaminated but before the equipment is reused for sampling. Equipment rinsate blanks will not be used when disposable or dedicated sampling equipment is used.
Field duplicate samples are independent samples collected as close as possible, in space and time, to a sample. Field duplicate samples can measure the influence of sampling and field procedures on the precision of an environmental measurement. They can also provide information on the heterogeneity of a sampling location. Immediately after a sample is collected, the field duplicate sample is collected using the same collection method.

MS/MSD and MS/MD samples are laboratory QC samples for organics analyses. These samples are used to measure the precision and accuracy of the laboratory organic analytical program. Solid MS/MSD and solid MS/MD samples do not require extra volume (except for VOCs, which require double volume).

Aqueous samples are collected from one sampling location at triple the normal sample volume for all organic analyses and double volume for all inorganic analyses. In the laboratory, MS/MSD and MS/MD samples are split, and two portions are spiked with known amounts of analytes.

MS/MD samples are used to measure the accuracy and precision of laboratory analyses of inorganic and general chemistry parameters. MS samples are used to measure accuracy, while MS/MD samples are used to measure precision.

QC checks for field measurements will consist mainly of initial and continuing calibration checks of field equipment. When applicable, QC check standards independent of the calibration standards will be used to check equipment performance. For example, to check the accuracy of field equipment such as a pH meter, standard buffer solutions independent of the calibration standards may be used. The precision of field measurements will typically be checked by taking replicate measurements.

7.4 Field Instrumentation

This section outlines the procedures and guidelines that will be followed to ensure equipment and instruments function accurately and consistently.

7.4.1 Field Instrument and Equipment Testing, Inspection, and Maintenance Requirements

This section discusses testing, inspection, and maintenance procedures for field and laboratory equipment and instruments. Kleinfelder will lease equipment through a national account supply agreement with properly procured vendors, depending on the type and availability of field instruments.

Instrument testing, inspection, and maintenance procedures are based on the following:

- Type of instrument;
- Instrument’s stability characteristics;
- Required accuracy, sensitivity, and precision of the instrument;
- Instrument’s intended use, considering project-specific DQOs;
- Instrument manufacturer's recommendations; and
- Other conditions affecting measurement or operational control

For most instruments, preventive maintenance is performed in accordance with procedures and schedules recommended in the instrument manufacturer's literature or operating manual or SOPs associated with particular applications of the instrument.

In some cases, testing, inspection, and maintenance procedures and schedules will differ from the manufacturer's specifications or SOPs. Procedures or schedules can differ, for example, when a field instrument is used to make critical measurements or when the analytical methods associated with a laboratory instrument require more frequent testing, inspection, and maintenance.

The equipment vendor is responsible for checking the equipment that it leases to Kleinfelder. Copies of testing, inspection, and maintenance procedures will be shipped to the field with the equipment and instruments. Once in the field, Kleinfelder field team leaders assume responsibility for testing, inspection, and maintenance.

Once arriving at the site, field equipment and instruments will be inspected for damage. Damaged equipment and instruments will be replaced or repaired immediately. Battery-operated equipment will be checked to assure full operating capacity; if needed, batteries will be recharged or replaced. Critical spare parts such as tape, paper, pH probes, electrodes, and batteries will be kept on site to minimize equipment downtime. To prevent delays in the field schedule, backup instruments and equipment will be available on site or within a 1-day shipping period.

Following use, field equipment will be properly decontaminated before being returned to its source. When the equipment is returned, copies of any field notes regarding equipment problems will be included so that problems are not overlooked and necessary equipment repairs are carried out.

7.4.2 Field Instrument Calibration and Frequency

This section describes the procedures for maintaining the accuracy of equipment used to collect field data.

The Kleinfelder field team leader will examine field sampling and measurement equipment upon arrival to verify that it is in good working condition. The manufacturer's operating manual and instructions that accompany the equipment will be consulted to ensure that all calibration procedures are followed. The SOPs listed in Table 3 describe calibration procedures, frequency, standards, control limits, and corrective actions.

7.5 Data Management

Data for the RI will be obtained from a combination of sources, including field measurements, field analyses, and laboratories. The process of collecting and managing data is a coordinated effort and will be conducted by project staff and laboratories working closely together. Laboratory data will be provided, when appropriate, in the form of an electronic data deliverable, in addition to the required hard copy analytical data package. Data will be formally verified (or validated) before associated results are presented or used in subsequent activities.

Data tracking is imperative to ensure timely, cost-effective, and high-quality results. Data tracking begins with sample chain of custody. When the laboratory receives the samples, a sample acknowledgment will be sent to Kleinfelder. The acknowledgment will confirm sample receipt, condition, and required analyses. The tracking program will contain all pertinent information about each sample and will track the data at each phase of the process. The tracking program carries the data through completion of data validation.

8.0 SCHEDULE

The following brief project schedule is planned:

- Field Investigations: October 2007 through April 2008
- Data Analysis: April 2007 through June 2008
- Draft Preliminary Site Characterization Summary Report: July 2008
- Draft Baseline Human Health Risk Assessment: August 2008
- Draft Screening Level Ecological Risk Assessment: July 2008
- Draft Remedial Investigation Report: November 2008
- Draft Feasibility Study Report: December 2008

A detailed schedule of all activities is available in the RI/FS Work Plan.